Final Report

# Texas Public Prekindergarten Class Size and Student-to-Teacher Ratio Study

Contract # 3494

September 2016

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Submitted to:
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# ACKNOWLEDGMENTS

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# Highlights

In 2015, the 84th Texas Legislature, Regular Session, passed House Bill (HB) 4 focused on high-quality prekindergarten programming.[1] A key aspect of the bill was authorizing and funding the HB 4 High-Quality Prekindergarten Grant program, which the Texas Education Agency (TEA) awarded in July 2016 for the 2016–17 school year.[2] HB 4 also specified expansion of early education reporting requirements for all Texas public schools offering a prekindergarten program beginning in the 2016–17 school year. Finally, HB 4 specified that a study be conducted to understand the relationship between quality and class size and student-to-teacher ratios in prekindergarten. This report meets the HB 4 study requirement. Highlights of findings from the study are provided here.

## Current (2016–17 school year) Texas Education Code Related to Prekindergarten Programs

- Texas Education Code (TEC) § 29.153 (2015) specifies that Texas public school districts are required to offer a free prekindergarten program if they identify 15 or more eligible children who are at least four years of age by September 1 of the current school year. A school district may offer prekindergarten classes if the district identifies 15 or more eligible children who are at least three years of age. Eligible children are defined as those who are English language learners, educationally disadvantaged, homeless, in a military family or have ever been in conservatorship with the Department of Family and Protective Services (DFPS).[3]
- Current TEC does not mention or recommend any maximum class size for prekindergarten classrooms.
- School districts offering high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program are encouraged to attempt to maintain an average student-to-teacher ratio of 11:1 (TEC § 29.167(d), 2015).
- TEA provides general guidance that prekindergarten ratios not exceed the minimum of the 22:1 student-to-teacher ratio required for kindergarten through fourth grade (TEC § 25.112, 2015).[4]
- As required by HB 4, the Early Childhood Data System includes new reporting requirements in place for the 2016–17 school year. These new data points will facilitate a clearer understanding of class size and student-to-teacher ratio in prekindergarten programs.

## Recommendations

Research indicates that for children to be ready for kindergarten and to be successful in school, it takes a combination of structural and process components in the prekindergarten classroom. Structural components may include class size, student-to-teacher ratio, and teacher compensation. Process components may include quality of teacher-child interactions, access to stimulating resources, and the types of activities in which a child is engaged. Both class size and student-to-teacher ratio influence the ability to provide effective process components. Furthermore, implementing a smaller class size without also addressing student-to-teacher ratios may decrease the potential positive impact on student outcomes. Therefore, our recommendations are presented in conjunction with one another because a class size standard that does not have an appropriate accompanying student-to-teacher ratio standard is unlikely to contribute to the conditions that greatly affect quality in the classrooms. Thus, based on the three study component findings it is recommended that

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[1] See http://www.legis.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4

[2] See for additional information http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/House_Bill_4_High-Quality_Prekindergarten_Grant_Program/; see also Texas Education Code (TEC) § 29.1545 (2015)

[3] See TEC § 29.153(b) (2015), SAAH, Section 7.2 http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.153

[4] See TEC § 25.112 (2015), TEC § 29.1532(b) (2015), http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/Top_10_Frequently_Asked_Questions_on_Early_Childhood_in_Texas/#4._What_is_the_class_size_and_student_to

*Class size guidelines should be set to a maximum not to exceed 22 students per prekindergarten classroom. Given the class size recommendation, a student-to-teacher ratio not to exceed 11:1 is recommended for all public prekindergarten classes with between 16 and 22 students. In cases where class size is 15 or fewer students, a student-to-teacher ratio should not exceed 15:1. However, following these guidelines alone will not ensure conditions for high-quality prekindergarten classrooms.*

School districts and open-enrollment charter schools should also consider the needs of their student populations as some populations may need smaller maximums to be effective. For example, programs serving students with special needs or English language learners may decide smaller class sizes and student-to-teacher ratios are most appropriate for best practice in their community. Following are findings from the study associated with making the recommendations.

### CLASS SIZE RECOMMENDATION

Supporting information for the class size recommendation follows.

- **Literature Review**. None of the early childhood education programs in the literature review that were associated with positive outcomes for children had a class size over 22. In fact, when the research focused on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students.
  - Guidelines from national organizations on maximum class size are between 20 and 22 for four-year-olds (increasing to 20-24 for five-year-olds). While the preponderance of these guidelines instruct not to exceed 20 students in prekindergarten, research to clearly establish 20 versus 22 was not identified.
  - The *State of Preschool 2015* reported that across the nation, 86% of all states met the quality standard for class sizes of 20 children or fewer (Barnett et al., 2016).
  - National reviews examining progress in specific states focused on high-quality prekindergarten education also consistently find guidelines that class size not exceed 20 students (e.g., Wechsler, 2016).

- **Texas Guidelines**. Current Texas guidance is in line with the recommendation.
  - Texas Rising Star standards, in line with national Quality Rating and Improvement System (QRIS) guidance, assign the highest points for classrooms of four-year-olds not exceeding 21 students in size and for classrooms of five-year-olds not exceeding 25 students in size.
  - The DFPS minimum standards for child care allow for a maximum group (class) size of 35.
  - TEA currently recommends that prekindergarten programs not exceed a class size of 22 for kindergarten through Grade 4.

- **Texas Public Prekindergarten Data.** Both the analysis of available data provided by TEA and data collected during the observation study suggest that a large number of Texas public prekindergarten programs were already meeting the recommendation of class sizes not to exceed 22 students. Based on this information, should the state establish clear standards with regard to class size, only a small number of prekindergarten programs would need to change from current practice.
  - Just under 20% of districts reported prekindergarten data in the voluntary Texas Early Childhood Data System (ECDS) for the 2014–15 school year. Compared to Texas Public Education Information Management System data for the same year suggests that the reporting districts were similar to the state as a whole with regard to student demographics. The ECDS data analysis indicates that the average class size of public prekindergarten programs in Texas was around 17 students and that 72% had class sizes of 20 or fewer students while 87% had class sizes of 22 or fewer students.

♦ An observation study conducted in 97 classrooms at 32 campuses in 16 Texas districts similarly suggested that most prekindergarten programs had class sizes of 22 or fewer students (80%) and no class was larger than 29 students.[5]

♦ Among observed classrooms scoring the highest on each quality rating domain, class size ranged from 13 (in classrooms rated highest on Instructional Support) to 18 (in classrooms rated highest on Emotional Support). That is, the highest quality scores were in those classrooms with average class sizes of 18 or fewer students.

## STUDENT-TO-TEACHER RATIO RECOMMENDATION

Supporting information for the student-to-teacher ratio recommendation follows.

- **Literature Review**. The preponderance of literature reviewed suggested that early childhood education classrooms associated with positive outcomes for children not exceed a student-to-teacher ratio of 11:1.
  ♦ When the research focused on components of high-quality prekindergarten and other early childhood education programs, the student-to-teacher ratios were between 8:1 (15:2) and 11:1 (22:2).[6]
  ♦ The national guidelines for student-to-teacher ratios vary by age group (3 and 4 to 5 years of age) and are between 7:1 and 12:1.
  ♦ *The State of Preschool 2015* reported that across the nation, 88% of states met the quality standard of 10 children for 1 adult per classroom. Other states reported student-to-teacher ratios between 8:1 and 10:1 (Barnett et al., 2016).

- **Texas Guidance.** Per state statute, the current guidance for Texas school districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the HB 4 High-Quality Prekindergarten Grant program is to maintain an average ratio of not less than one certified teacher or teacher's aide for every 11 students.

- **Texas Public Prekindergarten Data**. ECDS data from 2014–15 were insufficient to calculate student-to-teacher ratios. The observation study of 97 classrooms at 32 campuses in 16 districts did provide some guidance.
  ♦ In the observed classrooms, the average ratio was 12:1, only slightly higher than the recommendation.
  ♦ In approximately one-third of observed classrooms (37%), there was only one teacher in the classroom throughout the time the classroom was observed. It is unknown the extent to which this end of year observation reflected typical ratios from throughout the year.
  ♦ Among the observed classrooms with the highest quality scores, the student-to-teacher ratio ranged from 8:1 to 11:1. Observed classrooms with these ratios had the highest ratings on Instructional Support and Emotional Support domains respectively.
  ♦ The difference in quality scores was not statistically significant until a comparison was made between classrooms with ratios of 15:1 or fewer versus 16:1 and higher. Classrooms with student-to-teacher ratios of 15:1 or less were associated with significantly higher quality rating scores than classrooms with higher student-to-teacher ratios (16:1 and above).
  ♦ In classrooms with ratios of 15:1 and lower, several best practices were observed including more analysis and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, and repetition and extension.
  ♦ Although the student-to-teacher ratio of 15:1 or less from the classroom observation data is higher than the ratio suggested by research (no more than 11:1), preliminary findings from the observation study suggest that ratios within this range may be associated with high-quality and positive child outcomes. Setting the

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[5] The study team observed the selected classrooms using the Classroom Assessment Scoring System for prekindergarten (CLASS® PreK) to assess quality. For additional information on CLASS PreK see http://teachstone.com/classroom-assessment-scoring-system/age-levels/age-levels-pre-k/

[6] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

recommended student-to-teacher ratios not to exceed 11:1 for class sizes of 16 to 22 and not to exceed 15:1 for class sizes of up to 15 would provide Texas public prekindergarten classrooms that currently exceed the 15:1 ratio motivation for progressing towards lower student-to-teacher ratios that may support quality. Furthermore, the study team recommends that once a class size of 16 is achieved, classrooms need at least two teachers (or one teacher and an educational aide).

## Suggestions for Future Research and Texas Data Analyses

- Additional rigorous longitudinal research is needed to determine the relative contributions of various classroom quality factors, including class size and student-to-teacher ratio, on child outcomes from prekindergarten to Grade 3 and possibly beyond.

- Additional examination of the ECDS data collected as a result of new requirements to be reported in the ECDS starting in May 2017 will allow for more accurate identification of both class sizes and student-to-teacher ratios in public prekindergarten classrooms. These data should be tracked over time and aligned with indicators of classroom quality to continue to inform the relationship between structural components, process components, and quality.

# Executive Summary

## Purpose of the Study and Report

In Governor Abbott's 2015 State of the State Address, he set improving early education, specifically improving public prekindergarten, as the first of his five emergency items (State of Texas Office of Governor, 2016).[7] The 84th Texas Legislature then passed House Bill (HB) 4, which Governor Abbott signed into law in May 2015. HB 4 places renewed emphasis on high-quality prekindergarten programming through:

- Authorization for a new prekindergarten grant program providing additional funding to schools that meet "quality standards related to curriculum, teacher qualifications, academic performance, and family engagement".[8]
- Expansion of early childhood education reporting requirements for all Texas public schools offering prekindergarten programs beginning in the 2016–17 school year.

HB 4 also added Texas Education Code (TEC) § 29.1545 (2015), which requires that the Texas Education Agency (TEA) conduct a joint study with the DFPS to develop recommendations regarding optimal class sizes and student-to-teacher ratios for prekindergarten classes.[9] At the time of this report, rules or laws specifying prekindergarten class sizes and student-to-teacher ratios in Texas have not yet been established;[10] however, the following guidance exists:

- TEA encourages local education agencies (LEAs) to maintain and not exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms (TEC § 25.112, 2015).[11]
- School districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program "…must attempt to maintain an average ratio in any prekindergarten program class of not less than one certified teacher or teacher's aide for every 11 students," per the addition of TEC § 29.167(d) (2015) by HB 4.[12]

> **Class size** is the maximum number of children that can be in a classroom.
>
> **Student-to-teacher ratio** is the maximum number of students per adult in a classroom.

According to TEC § 29.1545 (2015), the study recommendations regarding optimal class size and student-to-teacher ratios should be based on:

- Data collected from prekindergarten programs, including high-quality prekindergarten programs under Subchapter E-1, reported through the Public Education Information Management System (PEIMS); and
- Observations of best practices and examples from effective prekindergarten programs across the state.

The purpose of this report is to share findings and recommendations with the Texas Legislature from this study, conducted by ICF International and Gibson Consulting Group (study team), on behalf of the TEA and DFPS. TEA provides recommendations to Texas public prekindergarten programs and is responsible for the HB 4 High-Quality Prekindergarten Grant program. DFPS sets minimum standards and is responsible for licensing of early childhood settings outside of public prekindergarten.

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[7] See http://gov.texas.gov/news/press-release/20543 and http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4

[8] See http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/House_Bill_4_High-Quality_Prekindergarten_Grant_Program/ and 19 TAC §102.1003, 2016.

[9] See TEC § $29.1545 (2015) at http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1545

[10] TEC § 25.111 (2015) does specify that each school district employ a sufficient number of certified teachers to maintain an average ratio of not less than one teacher for each 20 students in membership and through TEC § 25.112 (2015), LEAs are not to exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms.

[11] See TEC § 25.112 (2015) at http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.112. See also TEC § 25.113 (2015)http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.113 for class size exemptions

[12] See TEC § 29.167(d) (2015) http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.167

## Summary of the Study Approach

Based on study requirements in TEC § 29.1545 (2015) and guidance from TEA and DFPS, the study team conducted a study with three components to determine recommendations for optimal class sizes and student-to-teacher ratios for children in Texas public prekindergarten programs that included:

1. **Literature Review** to gather information from the latest research on optimal class size and student-to-teacher ratios.
2. **Extant Data Analysis** of TEA's available prekindergarten enrollment and kindergarten beginning of year (BOY) outcome data to describe prekindergarten programs in the state and identify prekindergarten programs on which to conduct observations.
3. **Observations** of 97 prekindergarten classrooms across 32 campuses in 16 districts within the state to examine class size and student-to-teacher ratios and to identify potential best practices and examples from prekindergarten programs across the state.

Although the literature review was not required by TEC § 29.1545 (2015), TEA and DFPS included it as a study component due to known limitations in the data system, timeline to conduct observations, and the added value it would bring to the analysis and recommendations. Through an examination of patterns of findings from across the three study components, the study team addressed the following four overarching research questions:

- **Research Question 1**. What is the current status of class size and student-to-teacher ratio in prekindergarten programs in Texas?
- **Research Question 2**. In what ways do prekindergarten class size and student-to-teacher ratio relate to prekindergarten quality and to students' school readiness and academic performance?
- **Research Question 3.** What are some best practices and examples from effective prekindergarten programs in Texas pertaining to class size and student-to-teacher ratio?
- **Research Question 4.** What are the recommended optimal class sizes and student-to-teacher ratios for prekindergarten classes in Texas?

The study team addressed the research questions using the three study components in a mixed methods approach. Multiple methods allowed the study team to maximize the strengths of one method while filling in gaps or weaknesses of others, thus resulting in a more comprehensive examination of available data and information. Additionally, comparing findings across multiple data sources facilitated an in-depth assessment of how guidance on prekindergarten class size and student-to-teacher ratio can help improve education quality and effectiveness, resulting in a greater confidence in the recommendations made to the Texas Legislature.

## Study Limitations

The three strategies for arriving at recommendations for optimal class size and student-to-teacher ratio in prekindergarten classrooms each have limitations. Some of the limitations the reader should keep in mind include:

- Many factors affect the quality of prekindergarten programs. This includes, but is not limited to, class size and student-to-teacher ratio. Most research on the quality of prekindergarten programs and student outcomes does not isolate class size and/or student-to-teacher ratios, thus affecting the ability to draw conclusions from the literature review.
- TEA is only just beginning to collect comprehensive program and progress monitoring data for prekindergarten classrooms and students, as will now be required by HB 4. The ECDS was operational in the 2014–15 and 2015–16 school years but data submission was voluntary. Data elements in the ECDS were in the process of being revised during this study to meet the HB 4 requirements. The study team and TEA agreed on a calculation for class size based on the 2014–15 school year data elements, but this element is expected to be more directly

calculated in the future. It was also agreed that the currently available data from ECDS were insufficient to calculate student-to-teacher ratios.

▪ This study was conducted within a four-month timeframe (April 21, 2016 to August 31, 2016) and decisions about study parameters were made accordingly. Most notably, the sample of high-quality prekindergarten programs for observations was based on the best campus-level data available at the very beginning of the study when sites needed to be selected. The assumption when using campus-level data was made that elementary schools with the highest average BOY kindergarten progress monitoring scores in 2015–16 were implementing quality prekindergarten programs in 2014–15.[13] Of course, not all children attending kindergarten had necessarily attended prekindergarten and other reasons may explain the high BOY kindergarten progress monitoring scores. Additionally, the observations of the selected prekindergarten programs were conducted in spring of the 2015–16 school year based on the assumption that the factors that may have contributed to school readiness in 2014–15 were also in place in 2015–16. Thus, some findings, particularly from the observational analyses, may merit further research with a larger observation sample.

## Importance of High-Quality Early Childhood Education Programming

Research suggest that high-quality early childhood education not only directly benefits children and prepares them for school, but also provides benefits to society as a whole, such as increased labor force participation by parents and supporting state and regional economic growth (Child Care Aware of America, 2015; Committee on Economic Development, 2015).[14] From a cost-benefit analysis perspective, the benefits of providing high-quality prekindergarten outweigh the costs (Yoshikawa, et al., 2013; Temple & Reynolds, 2007; Heckman, 2011; Bartik, 2014). The evidence suggests that economic returns of high-quality prekindergarten programs exceed most other educational interventions, especially those that begin during the school-age years, such as reduced class sizes in the elementary grades, grade retention, and youth job training (Temple & Reynolds, 2007).

### Defining High-Quality Early Childhood Education

The term high-quality is used to describe components of early childhood programs that researchers have found to be associated with development of physical, language, cognitive, social, and emotional skills that prepare a child for success in school. While researchers continue to debate what defines high quality, most suggest that both structural and process quality components must be present for a program to be considered high quality.

#### STRUCTURAL AND PROCESS QUALITY IN EARLY CHILDHOOD EDUCATION PROGRAMS

**Structural features** are considered to be foundational aspects of early childhood program quality that allow for higher process quality (Mashburn et al., 2008; Yoshikawa et al., 2013). The structural quality of a program includes class size, student-to-teacher ratio, teacher qualifications, length of the school day, adoption of a specified curriculum, teacher and staff compensation, and aspects of the physical environment such as square footage (Howes, et al. 2008; Mashburn, et al., 2008). This report focuses specifically on the structural features of class size and student-to-teacher ratio.

**Process quality** in early childhood education refers to the direct experiences children have within the program, such as teacher-child interactions, type of instruction, family engagement, and health and safety routines. Some research

> Researchers recommend that early childhood education programs need both structural and process quality components to promote strong learning and development outcomes in children.

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[13] Later in the study, through analysis that connected kindergarten BOY progress monitoring scores, the study team determined that 46% of the kindergarten students that had BOY 2015–16 data at the campuses selected for classroom observation were included in the ECDS 2014–15 data files.

[14] Early childhood education programs encompass Head Start, private child care (center-based and home-based), and public and private prekindergarten programs serving children from birth to eight years of age. For purposes of this report, early childhood education refers to all early childhood settings, and prekindergarten refers to public prekindergarten programs.

concludes that process quality dimensions of programs have the most significant impact on children's learning and development (Yoshikawa, et al., 2013).

## Early Childhood Education Context in Texas

Texas's legislative history, a state-supported council and initiatives, public prekindergarten, and licensed child care programs demonstrate the state's commitment to early childhood education, with HB 4 being the most recent example. In 1984, Texas became one of the first states in the nation to establish a prekindergarten program during the 68th Legislative Session, 2nd Called Session (1984), when HB 72 (Article IV, Part 13) established a half-day prekindergarten program for high-risk four-year-old students in Texas.[15] In 1999, Senate Bill (SB) 4, (76th Texas Legislature, Regular Session, 1999) added TEC § 29.155 (Texas Education Code, 1999) which set forth provisions for the first time awarding grants to schools for implementation or expansion of prekindergarten programs.[16]

In 2003, the Children's Learning Institute (CLI) at the University of Texas Health Science Center at Houston was designated by the Texas governor at that time (Rick Perry) as the Texas State Center for Early Childhood Development and was provided with funding through TEA. This support led to several research-based initiatives including development of curriculum and teacher professional development materials and resources referred to as the Center for Improving the Readiness of Children for Learning and Education (CIRCLE). CIRCLE was incorporated into the Texas School Ready initiative, a comprehensive preschool teacher training program, to offer curriculum and materials, professional development, coaching, and child progress monitoring with the goal of helping children be prepared for kindergarten (and beyond).[17]

The Texas Early Learning Council, an advisory council established by Governor Rick Perry in late 2009, made several improvements to the Texas early care and education multi-sector system between 2010 to 2013 (Texas Early Learning Council, 2013), such as creating new, voluntary, Infant, Toddler, and Three-Year-Old Early Learning Guidelines for Texas; establishing the Texas Early Childhood Professional Development System; writing recommendations for a statewide early childhood data exchange system (The On-Track System) and recommendations on the development of a state Quality Rating and Improvement System (QRIS).

In 2014, CLI began a partnership with TEA to plan and develop CLI Engage, a cost effective, digital platform to disseminate Texas School Ready's tools (e.g., child progress monitoring, classroom observation tools) across the state at no charge to eligible programs including public prekindergarten programs and Head Start grantees.[18]

The most current initiative is, in addition to what was previously noted, that HB 4 intends to support early childhood education in the following ways:[19]

- Allowing regional ESCs to offer teachers training that is required to be awarded a Child Development Associate (CDA) credential
- Clarification of expectations for charter schools providing prekindergarten education
- Amended TEC § 29.1532[20] regarding required data reporting on prekindergarten by districts to TEA using Public Education Information Management System (PEIMS) and TEC § 29.1543[21] regarding early childhood district- and campus-level reports provided by TEA

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[15] See http://www.lrl.state.tx.us/legis/billSearch/billdetails.cfm?billFileID=89324

[16] See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=76R&Bill=SB4

[17] For additional information about the Children's Learning Institute see https://www.childrenslearninginstitute.org/about-cli/. For additional information on Texas School Ready see https://www.childrenslearninginstitute.org/programs/texas-school-ready/

[18] For additional information about CLI Engage see https://cliengage.org/

[19] See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4

[20] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1532

[21] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1543

- Added TEC § 29.170[22] requiring the TEA commissioner to evaluate the use and effectiveness of HB 4 funding in improving student learning, with an initial report due December 2018
- Added TEC § 21.461[23] requiring the TEA commissioner to develop and offer prekindergarten teacher training.

## TEXAS PUBLIC PREKINDERGARTEN PROGRAMS AND THE HB 4 HIGH-QUALITY PREKINDERGARTEN GRANT PROGRAM

TEA oversees prekindergarten programs in public school districts and open enrollment charter schools in Texas. In the 2014–15 school year, 219,668 students were enrolled in Texas public prekindergarten programs (Texas Education Agency, 2016b).[24] To be eligible for free enrollment in a prekindergarten classroom, a child must be at least three years of age and:

- Unable to speak and comprehend the English language; or
- Educationally disadvantaged; or
- Homeless, as defined by 42 U.S.C. § 1143a, regardless of the residence of the child, of either parent of the child, or of the child's guardian or other person having lawful control of the child; or
- The child of an active duty member of the armed forces of the United States, including the state military forces or a reserve component of the armed forces, who is ordered to active duty by proper authority; or
- The child of a member of the armed forces of the United States, including the state military forces or a reserve component of the armed forces, who was injured or killed while serving on active duty; or
- Has ever been in the conservatorship of the DFPS following an adversary hearing held as provided by § 262.201, Family Code.[25]

Per TEC § 29.1531 (2015), districts may also offer tuition supported and district-financed prekindergarten to students beyond those eligible for free prekindergarten.[26]

During the 84th legislative session, the Texas Legislature passed HB 4 (TEC § 29.165, 2015) providing for a High-Quality Prekindergarten Grant program for school districts and open enrollment charter schools to implement increased quality standards in their prekindergarten classrooms. The High Quality Prekindergarten Grant funding is in addition to the half-day Foundation School Program formula funding of approximately $3,650 per eligible prekindergarten student that is already provided to districts and charters for provision of half-day prekindergarten. Grant funding for the program was set not to exceed $1,500 per eligible student, but could be lower depending on the number of eligible districts and students. In preparation for funding the new High-Quality Prekindergarten Grant program, TEA updated the Texas Prekindergarten Guidelines in 2015 to align with the Kindergarten Texas Essential Knowledge and Skills (TEKS) and reflect the latest research in what prekindergarten children should know and be able to do when entering kindergarten.[27] The new guidelines offer educators information and support to prepare all children for success in kindergarten (Texas Education Agency, 2015).

## TEXAS CHILD CARE PROGRAMS

DFPS' Child Care Licensing (CCL) Division provides oversight and licensing to 15,837 center-based and home-based child care programs in Texas.[28] These programs include licensed child care centers (i.e., child care programs, before or after-school programs, school-age programs), licensed child care homes, registered child care homes, listed family homes (listed family homes do not have minimum standards or training requirements and are not

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[22] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.170

[23] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.21.htm#21.463

[24] This count represents the number of three- and four-year-olds enrolled in half- or full-day public prekindergarten programs.

[25] See TEC § 29.153(b) (2015), SAAH, Section 7.2 http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.153

[26] See TEC § 29.1531 (2015), http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.153

[27] Texas Prekindergarten Guidelines can be found on TEA's website at http://tea.texas.gov/pkg.aspx

[28] Numbers based on FY 2015 counts, and do not include 5,026 listed family homes which are not regulated by DFPS unless a report is received. See https://www.dfps.state.tx.us/child_care/other_child_care_information/childcare_types.asp

inspected unless a report is received), and 24-hour residential care facilities. They also provide technical assistance to child care providers on meeting licensing standards, rules, and laws.[29] Head Start centers are included in the programs over which DFPS CCL provides oversight and licensing but are also accountable to oversight from the Office of Head Start.[30] Standards set by the Office of Head Start for class size and student-to-teacher ratio are more stringent than guidelines set by TEA or DFPS (Table ES-1). DFPS minimum standards, which include class size and student-to-teacher ratios, were under review for revision at the time of preparation of this report.[31]

**Quality Rating and Improvement System**. As part of the federal reauthorization of the Child Care and Development Block grant in 2015, all states were encouraged to have a statewide Quality Rating and Improvement System (QRIS; Administration for Children and Families, 2016).[32] QRIS is a systematic approach for assessing, improving, and communicating the level of quality of early care and education and school age programs (e.g., a rating system of 2-star, 3-star, or 4-star with more stars indicating a higher level of quality). Texas's QRIS is the voluntary Texas Rising Star administered by the Texas Workforce Commission (TWC).[33] Texas Rising Star was one of the first tiered quality systems in the country (Texas Workforce Commission, 2015). However, because the program is voluntary, few center based early childhood programs (fewer than 1,000) participate in the QRIS with just under half (45%) achieving the highest rating.[34] Texas Rising Star includes, for each age group, guidelines for maximum class sizes and student-to-teacher ratios (as shown in Table ES-1 in the Key Findings section).

## Key Findings

Table ES-1 summarizes findings from across the three study components that are the foundation for the recommendations to the Texas Legislature. As shown in Table ES-1, the study found that there is no one specific class size and student-to-teacher ratio that current research, guidelines from national organizations focused on the quality of early childhood education, and policies within states that build quality early education systems agree upon as optimal. However, the literature review findings, extant data findings, and findings from the observational component of this study point to maximum class sizes and student-to-teacher ratios that should not be exceeded in order to create conditions for high-quality classrooms. Findings are presented for each of the research questions.

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[29] See https://www.dfps.state.tx.us/child_care/default.asp

[30] See http://www.acf.hhs.gov/ohs/about/what-we-do

[31] See https://www.dfps.state.tx.us/child_care/child_care_standards_and_regulations/ for additional information.

[32] See http://qrisnetwork.org/our-framework

[33] The 76th Texas Legislature, Regular Session (1999) also passed HB 3333 requiring local workforce development boards to establish graduated reimbursement rates for subsidized child care based on the TWC's designated vendor program, now known as Texas Rising Star. See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=76R&Bill=HB3333.

[34] See http://usa.childcareaware.org/wp-content/uploads/2015/10/Texas2.pdf

**Table ES-1: Key Findings by Study Component Associated with Class Sizes and Student-to-Teacher Ratios for Prekindergarten Aged Students**

| Study | Maximum (or Average) Class Size | Student-to-Teacher Ratio |
|---|---|---|
| **Literature Review Findings** | | |
| Prekindergarten programs associated with positive outcomes for children[1] | 22 | 8:1 (15:2)[11] to 11:1 (22:2)[12] |
| National guidelines for maximum class sizes[2] | 14 to 24 | 7:1 to 12:1 |
| NIEER quality standards for comparing states' prekindergarten policies (Note: In 2015, 86% of all states met the quality standard for class size and 88% for student-to-teacher ratio)[3] | 20 | 10:1 |
| Policies of three states (California, Florida, New York) of comparable size to Texas [4] | 20 | 8:1 to 10:1 |
| Guidelines from four states (Michigan, West Virginia, Washington, and North Carolina) that have built quality early education systems with strong outcomes[5] | 20 | 8:1 to 10:1 |
| Head Start Requirements (Federal Guidelines)[6] | 20 | 10:1 |
| **Existing Requirements and Standards for Texas Early Childhood Programs** | | |
| Texas Child Care Licensing Requirements for programs serving 4- and 5-year-olds (DFPS Child Care Center Minimum Standards)[7] | 35 | 18:1; 22:1 |
| Texas Rising Star (standard to achieve highest rating for programs serving 4- and 5-year-olds)[8] | 21; 25 | 10:1 (both age groups) |
| **Existing Guidelines for Texas Public Prekindergarten Programs** | | |
| TEA encourages local education agencies to maintain and not exceed the 22:1 ratio required for kindergarten through Grade 4 classrooms (TEC § 25.112, 2015)[9] | 22 | 22:1 |
| School districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program must attempt to maintain 11:1 student-to-teacher ratio[10] | 22 | 11:1 |
| **Texas Extant Data Results** | | |
| Public prekindergarten programs in Texas based on ECDS data (Note: 87% of Texas classrooms in 2014–15 that had class sizes at or below 22) | Average: 17 | Not Available |
| **Observed Sites for this Study** | | |
| Public prekindergarten classrooms (*n* = 97) in Texas at time of observation | Average: 17 | Average: 12:1 |

[1] Barnett, Jung, Min-Jong, & Frede, 2013; Barnett, Schulman, & Shore, 2004; Francis, 2014; Gormley, Gayer, Phillips, & Dawson, 2004; Heckman, Pinto, & Savelyev, 2013; Hustedt, Barnett, Kwanghee, & Figueras, 2009;
Karoly & Auger, 2016; Lipsey, Farran, Bilbrey, Hofer, & Dong, 2011; M. Schaaf, Peisner-Feinberg, R. LaForett, Hildebrandt, & Sideris, 2014; Mashburn, Hamre, Downer, & Pianta, 2006; Minervino, 2014; National Research Council, 2001; Peisner-Feinberg, Schaaf, Hildebrandt, Pan, & Warnaar, 2015; The National Day Care Study, 1980;
Wechsler et al. 2016a; Yoshikawa, et al., 2013

[2] Administration for Children and Families, 2008; American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education, 2011; National Accreditation Commission for Early Care and Education Programs, 2005; National Association for the Education of Young Children, 2016; The Condition of Education, 2016; United Federation of Teachers, 2010

[3, 4] The National Institute of Early Education Research, 2016

[5] Wechsler et al., 2016a

[6] Administration for Children and Families, 2008

[7] Texas Department of Family and Protective Services, 2015

[8] Texas Workforce Commission (2015)

[9] See TEC § 25.112 (2015) at http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.112. See also TEC § 25.113 (2015) http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.113 for class size exemptions.

[10] See TEC § 29.167(d) (2015) http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.167

[11] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

[12] Barnett, Jung, Min-Jong, & Frede, 2013; Gormley, Gayer, Phillips, & Dawson, 2004; Hustedt, Barnett, Kwanghee, & Figueras, 2009; Karoly & Auger, 2016; Lipsey, Farran, Bilbrey, Hofer, & Dong, 2011; M. Schaaf, Peisner-Feinberg, R. LaForett, Hildebrandt, & Sideris, 2014; Minervino, 2014; Peisner-Feinberg, Schaaf, Hildebrandt, Pan, & Warnaar, 2015; Wechsler et al., 2016a

## What is the current status of class size and student-to-teacher ratio in prekindergarten programs in Texas?

The findings related to this question are described first as associated with class size, followed by student-to-teacher ratio findings.

### WHAT IS THE CURRENT STATUS OF CLASS SIZE IN TEXAS PREKINDERGARTEN PROGRAMS?

According to the National Institute for Early Education Research (NIEER) *The State of Preschool 2015* report that reviews states' public prekindergarten programs according to 10 research-based quality standards, 86% of all states reported meeting the stricter quality standard for class sizes of 20 children or fewer (Barnett et al., 2016). According to NIEER, Texas did not meet this standard (Barnett, et al., 2016). Given the overall research review, the study team examined the Texas context relative to a class size of 22 (or below). Based on analysis of data reported by school districts in ECDS during the 2014–15 school year, the average class size of the majority of Texas public prekindergarten programs was 17 students with the majority of these programs having class sizes of 22 or fewer students (87%), within national and Texas guidelines for quality programs (i.e., 22 or fewer students).[35] Observations of highly-rated prekindergarten programs as part of this study provided further evidence of this finding. The average class size (at the time of the observation) among the 97 public prekindergarten programs observed was 17 with the majority of these classrooms having a class size of 22 or fewer students (84%). To the extent that ECDS and the observed classrooms represent the broader public prekindergarten population, these findings suggest that the majority of Texas classrooms are at or near a class size of 22 or fewer students and would be able to meet this standard should it be set. However, approximately 13-16% of prekindergarten classrooms may need to make changes in order to meet a stricter recommendation.

### WHAT IS THE CURRENT STATUS OF STUDENT-TO-TEACHER RATIO IN PREKINDERGARTEN PROGRAMS IN TEXAS?

According to the NIEER *The State of Preschool 2015* report that reviews states' public prekindergarten programs against 10 research-based quality standards, 88% of states reported meeting the quality standard of 1 adult for every 10 children (Barnett et al., 2016). According to NIEER, Texas did not meet this standard because Texas does not have a limit as part of its state prekindergarten requirements (Barnett, et al., 2016). Due to the lack of available extant data, the study team was unable to calculate student-to-teacher ratios of Texas public prekindergarten programs (i.e., prekindergarten programs that entered data in ECDS did not provide data on teacher aides in the classroom, eliminating this study component as a source for forming recommendations).

Observations of highly-rated prekindergarten programs as part of this study indicated that in 63% of the classrooms observed, there were two or more instructional staff (e.g., teachers or educational aides) in the classroom for at least one of the three (12-minute) observation cycles and in 52% of the classrooms observed, two or more teachers or educational aides were present for all three observation cycles. Although the student-to-teacher ratio of 11:1 is recommended for the High-Quality Prekindergarten Grant program, it is worth noting that only 58% of the observed classrooms met or exceeded this expectation; 25% of the observed classrooms had a student-to-teacher ratio of 16:1 or higher.

## In what ways do prekindergarten class size and student-to-teacher ratio relate to students' school readiness and academic performance?

To date, research has not been able to establish that class size and student-to-teacher ratio alone have a causal impact on child outcomes. Simply lowering student-to-teacher ratio and class size without addressing other components does little to enhance child outcomes and increase school readiness among prekindergarten children. Research does indicate, however, that structural features like small class sizes and student-to-teacher ratios create

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[35] While the ECDS data is voluntary, analyses suggested it may be representative of prekindergarten programs in Texas more generally at least on student characteristics.

conditions for increased process features of increased high-quality social and instructional interactions in the classroom that greatly contribute to positive child outcomes.

The prekindergarten classroom observations and corresponding analyses conducted as part of this study did not find a clear linear relationship between class sizes and student-to-teacher ratios and the quality of classrooms as measured by teacher-student interactions (i.e., CLASS PreK scores). That is, as class size or student-to-teacher ratios increased, there was not a corresponding change (increase or decrease) in the quality of teacher-student interactions. However, classrooms with ratios higher than 15:1 had significantly lower overall CLASS PreK scores, including lower Emotional Support and Instructional Support scores, which suggests that quality interactions were less likely to occur in classrooms exceeding 15:1 student-to-teacher ratios. While classrooms were selected for potential to be high-quality, approximately 27% had student-to-teacher ratios that were associated with lower quality scores. This finding merits further research with a larger observation sample. For class size, the largest class size observed was 29 students and generally there was a limited number of classrooms with both small numbers of students and large numbers of students which may explain the inability to establish a linear relationship with quality.

### What are some best practices and examples from effective prekindergarten programs in Texas pertaining to class size and student-to-teacher ratio?

As part of the prekindergarten classroom observations conducted in this study, the study team reviewed the observational field notes of instructional practices from the classrooms that the observers rated the highest on the CLASS PreK. In all three areas measured by the CLASS PreK instrument (Emotional Support, Classroom Organization, and Instructional Support), the 10 highest rated classrooms across these three areas had lower than average student-to-teacher ratios. However, on average, classrooms rated highest on the Instructional Support domain had four fewer students per teacher than the average for the entire observation sample (8:1 versus 12:1). Observed classrooms with the highest Concept Development, Quality of Feedback, and Language Modeling Class PreK dimension scores also had lower student-to-teacher ratios. In addition, classrooms with the highest Instructional Support domain scores had on average 3.2 fewer students than the average of the observation sample. In these highly rated classrooms, high-performing teachers consistently engaged students in meaningful discussions though the use of open-ended questions, inquiry-based (e.g., how and why) questions, repetition and extension of student responses, the use of advanced language, and other techniques to challenge students to think deeper about the content being covered. Within these classrooms, many examples of best practices were observed, such as analysis and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, repetition and extension.

## Recommendations

Research indicates that for children to be ready for kindergarten and to be successful in school, it takes a combination of structural and process components in the prekindergarten classroom. Structural components may include class size, student-to-teacher ratio, and teacher compensation. Process components may include quality of teacher-child interactions, access to stimulating resources, and the types of activities in which a child is engaged. Both class size and student-to-teacher ratio influence the ability to provide effective process components. Furthermore, implementing a smaller class size without also addressing student-to-teacher ratios may decrease the potential positive impact on student outcomes. Therefore, our recommendations are presented in conjunction with one another because a class size standard that does not have an appropriate accompanying student-to-teacher ratio standard is unlikely to contribute to the conditions that greatly affect quality in the classrooms. Thus, based on the three study component findings it is recommended that

> *Class size guidelines should be set to a maximum not to exceed 22 students per prekindergarten classroom. Given the class size recommendation, a student-to-teacher ratio not to exceed 11:1 is recommended for all public prekindergarten classes with between 16 and 22 students. In cases where class size is 15 or fewer students, the*

***student-to-teacher ratio should not exceed 15:1. However, following these guidelines
alone will not ensure conditions for high-quality prekindergarten classrooms.***

School districts and open-enrollment charter schools should also consider the needs of their student populations as some populations may need smaller maximums to be effective. For example, programs serving students with special needs or English language learners may decide smaller class sizes and student-to-teacher ratios are most appropriate for best practice in their community. Following are findings from the study associated with making the recommendations.

## Class Size Recommendation

The preponderance of evidence in the literature review suggests that class sizes in prekindergarten classrooms not exceed 20 students. This includes both the recommendations of professional organizations and reviews of class size guidelines from other states, particularly those associated with a focus on quality prekindergarten education. Still, some professional organizations suggest that as many as 22 students may also be associated with quality. In addition, the majority of the research is primarily theoretical rather than evidence-based studies designed to identify a single class size.[36] The study team thinks the research to date suggests that a class size not exceeding 22 students may be as likely to support quality as one with 20 students.

In addition, the recommendation not to exceed a class size of 22 students is in line with actual class sizes for the majority of Texas public prekindergarten classrooms. Specifically, an examination of ECDS 2014–15 data, including data from just over 3,000 classrooms, found an average class size of 17 students in Texas public prekindergarten programs and that 72% of the programs had class sizes of 20 or fewer students while 87% had class sizes of 22 or fewer students. This suggests that, should the state establish clear standards with regard to class size, a small number of prekindergarten programs would need to change from current practice. Finally, the observation component of this study similarly suggested that most prekindergarten programs had class sizes of 22 students or fewer (80%) and no class was larger than 29 students. Among observed classrooms scoring the highest on each quality rating domain, class sizes ranged from 13 (Instructional Support) to 18 (Emotional Support). That is, higher quality scores occurred in classrooms with generally smaller average class sizes. While across all observations there was not a significant linear relationship between class size and CLASS PreK scores, this may be related to the small sample size and limited class sizes within the sample (from class size of 3 to 29 maximum).

## Student-to-Teacher Ratio Recommendation

The recommended class size of 22 is likely to be insufficient to support quality if a student-to-teacher ratio of 11:1 or better is not also established. The preponderance of literature suggests that prekindergarten classrooms not exceed student-to-teacher ratios of 10:1 to 11:1 for high-quality classrooms. When the research focused on components of high-quality prekindergarten and other early childhood education programs, the student-to-teacher ratios were between 8:1 (15:2) and 11:1 (22:2).[37] Student-to-teacher ratios were not available for the ECDS sample included in this study, so it is unknown to what extent Texas public prekindergarten classrooms on average were meeting or close to meeting this recommendation in the 2014–15 school year.

The observation component of this study occurred in only 97 classrooms at 32 campuses in 16 districts, but provided additional guidance on student-to-teacher ratios. Specifically, in the sample of observed classrooms, the average student-to-teacher ratio was 12:1, only slightly higher than the recommendation. In approximately one-third of observed classrooms, there was only one teacher in the classroom throughout the time the classroom was observed, although it is unknown to what extent this end-of-year observation reflected typical student-to-teacher ratios from throughout the school year. Among the observed classrooms with the highest quality scores, student-to-teacher

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[36] In other words, most of the research on this topic seeks to support program theory rather than to establish study conditions that set a definitive class size, if that were even possible.

[37] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

ratios ranged from 8:1 to 11:1. Observed classrooms with these ratios had the highest ratings on Instructional Support and Emotional Support domains. The difference in CLASS PreK quality scores was not significant until a comparison was made between classroom ratios of 15:1 or fewer versus 16:1 and higher. That is, classrooms with student-to-teacher ratios of 15:1 or less were associated with significantly higher quality on average than classrooms with higher student-to-teacher ratios. In classrooms with ratios of 15:1 and lower, several best practices were observed including more analysis and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, repetition and extension. Although the student-to-teacher ratio of 15:1 or less from the classroom observation data is higher than the ratio suggested by research (no more than 11:1), preliminary findings from the observation study suggest that both may be associated with high-quality and positive child outcomes based on the observation study. The range of 11:1 to 15:1 student-to-teacher ratios provides Texas public prekindergarten classrooms that currently exceed the 15:1 ratio motivation for progressing towards lower student-to-teacher ratios. Furthermore, the study team recommends that once a class size of 16 is achieved, classrooms need at least two teachers or one teacher and an educational aide.

## Additional Research Suggested

In conclusion, the limitations mentioned in this executive summary suggest the need for additional rigorous longitudinal research to determine the relative contributions of various classroom quality factors, including class size and student-to-teacher ratio, on child outcomes from prekindergarten to Grade 3 and possibly beyond. It also suggests the need for additional examination of the ECDS data collected as a result of new requirements to be reported in the ECDS starting in May 2017. These data should be tracked over time and aligned with indicators of classroom quality to continue to inform the relationship between structural components, process components, and quality.[38]

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[38] See http://castro.tea.state.tx.us/tsds/teds/2017A/Section102016_2017.pdf for revised ECDS data standards.

# Chapter 1: Introduction

## Purpose of the Study

In Governor Abbott's 2015 State of the State Address, he set improving early education, specifically improving public prekindergarten, as the first of his five emergency items (State of Texas Office of Governor, 2016).[39] The 84th Texas Legislature then passed House Bill (HB) 4, which Governor Abbott signed into law in May 2015. HB 4 places renewed emphasis on high-quality prekindergarten programming through:

- Authorization for a new prekindergarten grant program providing additional funding to schools that meet "quality standards related to curriculum, teacher qualifications, academic performance, and family engagement".[40]
- Expansion of early childhood education reporting requirements for all Texas public schools offering prekindergarten programs beginning in the 2016–17 school year.

HB 4 also added Texas Education Code (TEC) § 29.1545 (2015), which requires that the Texas Education Agency (TEA) conduct a joint study with the Texas Department of Family and Protective Services (DFPS) to develop recommendations regarding optimal class sizes and student-to-teacher ratios for prekindergarten classes. At the time of this report, rules or laws specifying prekindergarten class sizes and student-to-teacher ratios in Texas have not yet been established;[41] however, the following guidance exists:

> **Class size** is the maximum number of children that can be in a classroom.
>
> **Student-to-teacher ratio** is the maximum number of students per adult in a classroom.

- TEA encourages local education agencies (LEAs) to maintain and not exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms (TEC § 25.112, 2015).[42]
- School districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program "…must attempt to maintain an average ratio in any prekindergarten program class of not less than one certified teacher or teacher's aide for every 11 students," per the addition of TEC § 29.167(d) (2015) by HB 4.

According to TEC § 29.1545 (2015), the study recommendations regarding optimal class size and student-to-teacher ratios should be based on:

- Data collected from prekindergarten programs, including high-quality prekindergarten programs under Subchapter E-1, reported through the Public Education Information Management System (PEIMS); and
- Observations of best practices and examples from effective prekindergarten programs across the state.

The purpose of this report is to share findings and recommendations with the Texas Legislature from this study, conducted by ICF International and Gibson Consulting Group (study team), on behalf of the TEA and DFPS.

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[39] See http://gov.texas.gov/news/press-release/20543 and http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4
[40] See http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/House_Bill_4_High-Quality_Prekindergarten_Grant_Program/ and 19 TAC §102.1003, 2016.
[41] TEC § 25.111 (2015) does specify that each school district employ a sufficient number of certified teachers to maintain an average ratio of not less than one teacher for each 20 students in membership and through TEC § 25.112 (2015), LEAs are not to exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms.
[42] For the purposes of this report, the 22:1 is considered to be a class size recommendation. That is, the kindergarten through Grade 4 guideline is one teacher with a maximum class size of 22. The study team did not perceive the intention of the guideline to be that 44 students with 2 teachers would be appropriate.

## Summary of the Study Approach

Based on study recommendations in TEC § 29.1545 (2015) and guidance from TEA and DFPS, the study team conducted a three-part study to determine recommendations for the optimal class sizes and student-to-teacher ratios for children in Texas public prekindergarten programs that included:

1. **Literature Review** to gather information from the latest research on optimal class size and student-to-teacher ratios
2. **Extant Data Analysis** of TEA's available prekindergarten enrollment and kindergarten beginning of year (BOY) outcome data to describe prekindergarten programs in the state and identify prekindergarten programs on which to conduct observations.
3. **Observations** of 97 prekindergarten classrooms across 16 school districts and 32 campuses within the state to examine class size and student-to-teacher ratios and to identify potential best practices and examples from prekindergarten programs across the state.

Although the literature review was not included as a requirement in HB 4 TEC §29.1545 (2015), TEA and DFPS included it as a study component due to known limitations in the data system, timeline to conduct observations, and the added value it would bring to the analysis and recommendations. Through an examination of patterns of findings from across the three study components, the study team addressed the following four overarching research questions:

- **Research Question 1**. What is the current status of class size and student-to-teacher ratio in prekindergarten programs in Texas?
- **Research Question 2**. In what ways do prekindergarten class size and student-to-teacher ratio relate to prekindergarten quality and to students' school readiness and academic performance?
- **Research Question 3.** What are some best practices and examples from effective prekindergarten programs in Texas pertaining to class size and student-to-teacher ratio?
- **Research Question 4.** What are the recommended optimal class sizes and student-to-teacher ratios for prekindergarten classes in Texas?

The study team addressed the research questions using the three study components in a mixed methods approach. Multiple methods allowed the study team to maximize the strengths of one method while filling in gaps or weaknesses of others, thus resulting in a more comprehensive examination of available data and information. Additionally, comparing findings across multiple data sources facilitated an in-depth assessment of how guidance on prekindergarten class size and student-to-teacher ratio can help improve education quality and effectiveness, resulting in a greater confidence in the recommendations made to the Texas Legislature. See Appendix A for more information on the study design and methods.

## Importance of High-Quality Early Childhood Education Programming

Early childhood education programs encompass Head Start, child care (center-based and home-based), and public and private prekindergarten programs serving children from birth to eight years of age. For purposes of this report, early childhood education refers to all early childhood settings and prekindergarten refers to public prekindergarten programs. The Texas focus on improving early childhood education, including examining prekindergarten guidelines such as class size and student-to-teacher ratios, which are the focus of this report, occurs in a broader context of the importance of education in the early years. Texas's pursuit of engaging in high-quality prekindergarten exemplified by HB 4 is also in line with national trends. Wechsler et al. (2016a) conducted an analysis of how four states (Michigan, West Virginia, Washington, and North Carolina) have built quality early education systems with strong outcomes. A key finding was the prioritization in these states of quality and continuous improvement efforts, including defining and

using state quality standards that incorporate assessments of adult-child interactions, as well as structural factors, such as class size, student-to-teacher ratios, and facility requirements.

## Economics and Early Childhood Education

High-quality early childhood education not only directly benefits children and prepares them for school, but also provides benefits to society as a whole, such as increased labor force participation by parents and supporting state and regional economic growth (Child Care Aware of America, 2015; Committee on Economic Development, 2015). It is estimated that there are just under two million children under the age of five in the state of Texas. In the 2014–15 school year, 219,668 of these children attended Texas public prekindergarten.[43] Beyond direct academic skills, such as literacy and mathematics, teachers in high-quality early childhood education programs may help prepare young children to be ready for the workforce by helping them acquire important work and life skills, such as social skills, problem solving, persistence, and following directions (Yoshikawa, et al., 2013; National Research Council, 2001). In a survey conducted with business leaders and employers, 93% indicated that critical thinking, effective communication, and problem solving were more important than a person's college major when hiring personnel (Hart Research Associates, 2013).

From a cost-benefit analysis perspective, the benefits of providing high-quality prekindergarten outweighs the costs (Yoshikawa, et al., 2013; Temple & Reynolds, 2007; Heckman, 2011; Bartik, 2014). The evidence suggests that economic returns of high-quality prekindergarten programs exceed most other educational interventions, especially those that begin during the school-age years, such as reduced class sizes in the elementary grades, grade retention, and youth job training (Temple & Reynolds, 2007). Several studies have calculated the investments to be anywhere from three to seven dollars saved for every dollar spent (Barnett, Jung, Min-Jong, & Frede, 2013; Wong, Cook, Barnett, & Jung, 2008; Heckman, 2011). The return on investments to society are associated with higher high school graduation rates, labor force participation, stable household formation, and lower criminal behaviors (Wong, Cook, Barnett, & Jung, 2008; Heckman, 2011; Barnett, et al., 2013). Aguirre et al. (2006) conducted a cost-benefit analysis of establishing a public prekindergarten program in Texas that, if implemented, would serve 70% of all four-year-old children in the state, estimating that for every $1.00 invested in the proposed high-quality program the returns would be $3.50 per participant.[44]

## Early Childhood Education and Brain Development

In 2000, the landmark book "From Neurons to Neighborhoods" provided the basis for studying the relationship between early childhood educational research and brain development (Institute of Medicine, 2000).[45] Research has established that the first five years of life are important in setting the stage for lifelong learning (Institute of Medicine and National Research Council, 2012; National Research Council, 2001; Institute of Medicine, 2000) and that a child's environment plays a critical role in supporting the development of neurons in the brain that affect a range of early cognitive (early language, literacy, math, persistence, and attention) and social-emotional (empathy, prosocial behavior, and self-regulation) skills (Yoshikawa, et al., 2013). Additional studies have provided further support for the importance of high-quality early childhood education on children's brain development (Institute of Medicine and National Research Council, 2012; Duncan & Magnuson, 2013; La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012). High-quality interactions in early childhood education settings contribute to the context for creating the brain connections needed for developing problem solving and critical thinking skills crucial for school and life success. In fact, for children who experience various risks at home, a high-quality early childhood education program can buffer

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[43] This count represents the number of three- and four-year-olds enrolled in half- or full-day public prekindergarten programs.

[44] See http://bush.tamu.edu/research/capstones/mpsa/projects/TECEC2006/ACostBenefitAnalysisofHigh-QualityUniversally-AccessiblePre-KindergartenEducationinTexas.pdf.

[45] See http://www.nap.edu/catalog/9824/from-neurons-to-neighborhoods-the-science-of-early-childhood-development. A summary of updated research was published in 2012 http://www.nap.edu/catalog/13119/from-neurons-to-neighborhoods-an-update-workshop-summary.

toxic stress and help them develop essential coping skills. These children significantly benefit from relationships with reliable and responsive caregivers and teachers (Center on the Developing Child at Harvard University, 2016).

## Prekindergarten and its Impact on School Readiness

Skills that are developed during school and even into adulthood build cumulatively upon early skills (Yoshikawa, et al., 2013). Research has shown that high-quality prekindergarten programs positively impact three-and four-year-old children's school readiness and educational achievement, and this is especially important for economically disadvantaged children (Heckman, 2011; Duncan, Kalil & Ziol-Guest, 2013; Francis, 2014). School readiness refers to the whole child being ready across several domains. That is, school readiness not only means being academically ready, but also being physically, socially, and emotionally ready for learning. Many states now focus on school readiness as a goal for prekindergarten; however, a common definition of school readiness does not exist. The Texas Early Learning Council has done extensive work in defining school readiness for Texas children (Texas Early Learning Council, 2011). This definition encompasses not only academic domains, but the understanding that it takes a multi-dimensional, whole child approach to help children become school ready.

Large-scale public prekindergarten programs, such as those in New Mexico, Tulsa, and Boston, have shown substantial impacts on children's early learning and school readiness (Yoshikawa, et al., 2013). For example, prekindergarten children who attended Tulsa's program and were from economically disadvantaged families entered kindergarten 11 months ahead of children who did not attend prekindergarten (Gormley, Gayer, Phillips, & Dawson, 2004).

> **Texas Early Learning Council (2011) School Readiness Definition**
>
> School readiness is the state of early development that enables an individual child to engage in and benefit from kindergarten learning experiences. Children are "ready" for school when families, schools, and communities work together to ensure their developmentally appropriate, age-level success across a variety of domains, including:
> - Health
> - Social and Emotional Development
> - Language and Communication
> - Emergent Literacy - Reading
> - Emergent Literacy - Writing
> - Mathematics and Numeracy
> - Science
> - Social Studies
> - Fine Arts (Creativity)
> - Physical Development
> - Technology

Additionally, attending high-quality public prekindergarten in Miami, Florida as compared to subsidized child care was associated with improved school readiness for Hispanic children, particularly those who were economically disadvantaged (Ansari & López, 2015). This finding is particularly relevant to Texas given that Hispanic students currently make up the majority of students enrolled in Texas public schools. Enrollment statistics for the 2014–15 school year indicated that there were 2,722,272 Hispanic students in Texas public schools, representing 52% of the total enrollment (Texas Education Agency, 2016a).[46]

Other examples of research examining the effects of high-quality early childhood education programs on school readiness found the following positive outcomes:

- A meta-analysis of findings from 31 studies suggests that prekindergarten students demonstrated decreased externalizing behaviors (e.g., aggressive, antisocial, and rule-breaking behaviors) when compared to prekindergarten students in comparison groups (Schindlera, et al., 2015).
- The Boston Prekindergarten Program showed increases in children's end of year vocabulary, early reading, and numeracy, and larger than average gains were made by children whose primary language was Spanish as compared to students not participating in the program (Minervino, 2014).
- The Head Start Impact Study, started in 2002, indicated that, after one academic year in the program, four-year-olds who had the opportunity to enroll in Head Start made significant gains in six language and literacy areas as

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[46] See Enrollment Trends in Texas Public Schools 2014–15 (Texas Education Agency, 2016a) http://tea.texas.gov/acctres/enroll_index.html

compared to students not randomly selected to participate in the program (Duncan & Magnuson, 2013; U.S. Department of Health and Human Services, Administration for Children and Families, 2010).

## Defining High-Quality Early Childhood Education

While the body of evidence supports the significance of high-quality early childhood education programs for brain development and school readiness and success, what exactly is high quality? The term high quality is used to describe components of early childhood programs that researchers have found to be associated with children's positive development of language and cognitive functioning, social skills, and emotional well-being. Research over the past 40 years has consistently shown that early education programs that are considered high quality have a larger and more sustained positive influence on the development of young children than those that are not considered high quality (Yoshikawa, et al., 2013; Howes, et al., 2008; Minervino, 2014; Wechsler, et al., 2016b). However, researchers continue to debate specifically what defines high quality.

A content analysis of 76 studies conducted in the United States indicates a lack of a consistent definition of quality (La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012). While one study indicated that there was "no singular approach for conceptualizing, defining, or measuring preschool quality" (Mashburn & Pianta, 2010), most studies concluded that several components must be present for a program to be considered high quality. Additional research on what exactly comprises a high-quality program has concluded that components of high-quality programs can be grouped into structural and process quality components, and to achieve high-quality, both quality components must be present (La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012; Wong, Cook, Barnett, & Jung, 2008; Karoly & Auger, 2016; Yoshikawa, et al., 2013; Minervino, 2014).

> Researchers recommend that early childhood education programs need both structural and process quality components to promote strong learning and development outcomes in children.

### PROCESS QUALITY AND STRUCTURAL FEATURES IN EARLY CHILDHOOD EDUCATION PROGRAMS

**Process quality** in early childhood education research refers to the direct experiences children have within the program, such as teacher-child interactions, type of instruction, family engagement, and health and safety routines. Some research concludes that process quality dimensions of programs have the most significant impact on children's learning and development (Yoshikawa, et al., 2013). Recent research has focused on the role of teacher-child interactions on child outcomes. Teachers who are warm and responsive, effectively attend to children's needs, and use positive guidance techniques contribute to the child's feeling of being safe in the classroom, thus expanding their ability to learn. Many experts believe this is essential in any early childhood education classroom (La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012; Howes, et al., 2008; Karoly & Auger, 2016). Other aspects of individual teacher characteristics, such as personality and mental health, are increasingly being studied as possible predictors of classroom effectiveness (La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012).

**Structural features** are considered to be foundational aspects of early childhood program quality that allow for higher process quality (Mashburn et al., 2008; Yoshikawa et al., 2013). The structural quality of a program includes class size, student-to-teacher ratio, teacher qualifications, length of the school day, adoption of a specified curriculum, teacher and staff compensation, and aspects of the physical environment such as square footage of the classroom (Howes, et al. 2008; Mashburn, et al., 2008). This report focuses specifically on the structural features of class size and student-to-teacher ratio.

Most researchers recommend that programs need both structural and process quality components to promote strong learning and developmental outcomes in children (La Paro, Thomason, Lower, Kitner-Duffy, & Cassidy, 2012; Yoshikawa et al., 2013; Minervino, 2014). The National Institute for Early Education Research (NIEER) publishes annually The State of Preschool comparing all state public prekindergarten programs against 10 research-based quality components. While these components do not guarantee quality, NIEER suggests that research has shown that they represent the minimum criteria needed to ensure prekindergarten program effectiveness, particularly for children from economically disadvantaged families (Barnett, et al., 2016).

> **NIEER State of Preschool Quality Standards (Barnett, et al., 2016)**
> - Comprehensive Early Learning Standards
> - Teacher degree – BA or higher
> - Teacher specialization in prekindergarten
> - Assistant teacher education – CDA or higher
> - At least 15 hours of teacher training per year
> - Maximum class size - 20 or smaller
> - Maximum student-to-teacher ratio 10:1 or smaller
> - Screening, referral, and support services offered
> - At least 1 meal per day
> - Monitoring visit at least once every 5 years

In sum, research indicates that programs need both structural and process quality components to positively impact child outcomes. Structural features can more easily be regulated and often set a baseline foundation for quality practices to occur. While process features are more difficult to regulate, states can support quality in these areas by investing in training and coaching for teachers (Wechsler, et al., 2016a). Given the focus of this study specifically on prekindergarten class size and student-to-teacher ratio, specific relevant research on these topics is presented in the literature review in Chapter 2.

## Early Childhood Education Context in Texas

So far, literature reflecting national data has been presented. In order to understand the history and current context of public prekindergarten, the study team examined Texas's relevant legislative history and state initiatives. Texas's legislative history, state-supported council and initiatives, public prekindergarten, and licensed child care programs demonstrate the state's ongoing commitment to early childhood education, with HB 4 being the most recent example.

In 1984, Texas became one of the first states in the nation to establish a prekindergarten program during the 68th Legislative Session, 2nd Called Session (1984), when HB 72 (Article IV, Part 13) established a half-day prekindergarten program for high-risk four-year-old students in Texas.[47] In 1999, Senate Bill (SB) 4, (76th Texas Legislature, Regular Session, 1999) added TEC § 29.155 (Texas Education Code, 1999), which set forth provisions for the first time, awarding grants to schools for implementation or expansion of prekindergarten programs. In 2003, the Children's Learning Institute (CLI) at the University of Texas Health Science Center at Houston was designated by the Texas Governor at that time (Rick Perry) as the Texas State Center for Early Childhood Development and was provided with funding through TEA. This support led to several research based initiatives including development of curriculum and teacher professional development materials and resources referred to as the Center for Improving the Readiness of Children for Learning and Education (CIRCLE). CIRCLE was incorporated into Texas School Ready to offer curriculum and materials, professional development, coaching and child progress monitoring with the goal of helping children be prepared for kindergarten (and beyond).[48]

The Texas Early Learning Council, an advisory council established by Governor Rick Perry in late 2009, made several improvements to the Texas early care and education multi-sector system between 2010 to 2013 (Texas Early Learning Council, 2013), such as creating new, voluntary, Infant, Toddler, and Three-Year-Old Early Learning Guidelines for Texas; establishing the Texas Early Childhood Professional Development System; writing recommendations for a statewide early childhood data exchange system (The On-Track System), and

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[47] See http://www.lrl.state.tx.us/legis/billSearch/billdetails.cfm?billFileID=89324

[48] For additional information about the Children's Learning Institute see https://www.childrenslearninginstitute.org/about-cli/. For additional information on Texas School Ready see https://www.childrenslearninginstitute.org/programs/texas-school-ready/

recommendations on the development of a state Quality Rating and Improvement System (QRIS). In 2014, CLI began a partnership with TEA to plan and develop CLI Engage, a cost effective, digital platform to disseminate Texas School Ready's tools (e.g., child progress monitoring, classroom observation tools) across the state at no charge to eligible programs including public prekindergarten programs and Head Start grantees.[49]

The 84th Texas Legislature, Regular Session, passed HB 4, which Governor Abbott signed into law in May 2015.[50] The most current initiative is, in addition to what was previously noted, that HB 4 intends to support early childhood education in the following ways:[51]

- Authorization for a new prekindergarten grant program providing additional funding to schools who meet "quality standards related to curriculum, teacher qualifications, academic performance, and family engagement"[52]
- Expansion of early childhood education reporting requirements for all Texas public schools offering prekindergarten programs beginning in the 2016–17 school year
- Allowed regional ESCs to offer teachers training that is required to be awarded a Child Development Associate (CDA) credential
- Amended TEC § 29.1532[53] regarding required data reporting on prekindergarten by districts to TEA using Public Education Information Management System (PEIMS) and TEC § 29.1543[54] regarding early childhood district- and campus-level reports provided by TEA
- Added TEC § 29.170[55] requiring the TEA commissioner to evaluate the use and effectiveness of HB 4 funding in improving student learning, with an initial report due December 2018 and
- Added TEC § 21.461[56] requiring the TEA commissioner to develop and offer prekindergarten teacher training.

## TEXAS PUBLIC PREKINDERGARTEN PROGRAMS AND THE HB 4 HIGH-QUALITY PREKINDERGARTEN GRANT PROGRAM

TEA, the agency that administers public prekindergarten in Texas, supports high-quality early learning that promotes kindergarten school readiness for Texas children. In 2014–15, 219,668 students were enrolled in Texas public prekindergarten programs (Texas Education Agency, 2016b).[57] To be eligible for free enrollment in a prekindergarten classroom, a child must be at least three years of age and:

- Unable to speak and comprehend the English language; or
- Educationally disadvantaged; or
- Homeless, as defined by 42 U.S.C. § 1143a, regardless of the residence of the child, of either parent of the child, or of the child's guardian or other person having lawful control of the child; or
- The child of an active duty member of the armed forces of the United States, including the state military forces or a reserve component of the armed forces, who is ordered to active duty by proper authority; or
- The child of a member of the armed forces of the United States, including the state military forces or a reserve component of the armed forces, who was injured or killed while serving on active duty; or
- Has ever been in the conservatorship of the Texas DFPS following an adversary hearing held as provided by § 262.201, Family Code.[58]

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[49] For additional information about CLI Engage see https://cliengage.org/
[50] See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4
[51] See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4
[52] See http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/House_Bill_4_High-Quality_Prekindergarten_Grant_Program/ and 19 TAC §102.1003, 2016.
[53] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1532
[54] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1543
[55] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.170
[56] See http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.21.htm#21.463
[57] This count represents the number of three- and four-year-olds enrolled in half- and full-day public prekindergarten programs.
[58] See TEC § 29.153(b), § 29.153(b), § 29.153(b) (2015), Student Attendance Accounting Handbook, Section 7.2 http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.153

Per TEC § 29.1531 (2015), districts may also offer tuition supported and district-financed prekindergarten to students beyond those eligible for free prekindergarten.

During the 84th legislative session, the Texas Legislature passed HB 4 (TEC § 29.165, 2015) providing for a High-Quality Prekindergarten Grant program for school districts and open enrollment charter schools to implement increased quality standards in their prekindergarten classrooms. The High Quality Prekindergarten Grant funding is in addition to the half-day Foundation School Program formula funding of approximately $3,650 per eligible prekindergarten student that is already provided to districts and charters for provision of half-day prekindergarten. Grant funding for the program was set not to exceed $1,500 per eligible student, but could be much lower depending on the number of eligible districts and students. In preparation for funding the new High-Quality Prekindergarten Grant program, TEA updated the Texas Prekindergarten Guidelines in 2015 to align with the Kindergarten Texas Essential Knowledge and Skills (TEKS) and reflect the latest research in what prekindergarten children should know and be able to do when entering kindergarten.[59] The new guidelines offer educators the information and support to prepare all children for success in kindergarten (Texas Education Agency, 2015). Additionally, TEA indicated that to be eligible for the grant, school districts and open-enrollment charter schools have to conduct the following:[60]

- Implement a curriculum in specified domains
- Measure progress of each student using a progress monitoring tool and preparation of each student using a kindergarten readiness instrument for reading
- Employ teachers who are certified and meet specific additional qualifications
- Develop, implement and make available a family engagement plan
- Report on the curriculum, prekindergarten instruments, and the kindergarten readiness instrument used and the results on all the instruments used
- Select and implement appropriate methods for evaluating the program and student progress
- Make evaluation data available to parents
- Attempt to maintain an average ratio in any prekindergarten program class of not less than one certified teacher or teacher's aide for every 11 students
- Use funding to improve the prekindergarten program quality
- Maintain locally and provide at the TEA's request the necessary documentation to ensure fidelity of program implementation

## TEXAS CHILD CARE PROGRAMS

While TEA provides oversight on public prekindergarten, DFPS' Child Care Licensing (CCL) Division provides oversight and licensing to over 15,837 center-based and home-based child care programs in Texas.[61] These programs include licensed child care centers (i.e., child care programs, before or after-school programs, school-age programs), licensed child care homes, registered child care homes, listed family homes (listed family homes do not have minimum standards or training requirements and are not inspected unless a report is received), and 24-hour residential care facilities. CCL also provides technical assistance to child care providers on meeting licensing standards, rules, and laws.[62] Head Start centers are included in the programs over whom DFPS CCL provides oversight and licensing but are also accountable to oversight from the Office of Head Start.[63] As will be discussed in Chapter 2, standards set by the Office of Head Start for class size and student-to-teacher ratio are more stringent than the standards and guidelines set by TEA or DFPS. DFPS minimum standards, which includes class size and

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[59] Texas Prekindergarten Guidelines can be found on TEA's website at http://tea.texas.gov/pkg.aspx

[60] Details were specified in Texas Education Code, Subchapter 102. Educational Programs Subchapter AA. Commissioner's Rules Concerning Early Childhood Education Programs (2016), and 19 TAC §102.1003, 2016.

[61] Numbers based on FY 2015 counts, and do not include 5,026 listed family homes which are not regulated by DFPS unless a report is received. See https://www.dfps.state.tx.us/child_care/other_child_care_information/childcare_types.asp

[62] See https://www.dfps.state.tx.us/child_care/default.asp

[63] See http://www.acf.hhs.gov/ohs/about/what-we-do

student-to-teacher ratios for child care programs, were under review for revision at the time of preparation of this report.[64]

**Quality Rating and Improvement System**. As part of the federal reauthorization of the Child Care and Development Block grant in 2015, all states were encouraged to have a statewide Quality Rating and Improvement System (QRIS; Administration for Children and Families, 2016).[65] QRIS is a systematic approach for assessing, improving, and communicating the level of quality of early care and education and school age programs (e.g., a rating system of 2-star, 3-star, or 4-star with more stars indicating a higher level of quality). QRIS typically includes five components: (1) program standards and criteria; (2) program accountability associated with assigned rating levels; (3) workforce and provider support; (4) provider incentives; and (5) parent/consumer education. Texas's QRIS is the voluntary Texas Rising Star administered by the Texas Workforce Commission (TWC).[66] Texas Rising Star was one of the first tiered quality systems in the country (Texas Workforce Commission, 2015). However, because the program is voluntary, few center-based early childhood programs (fewer than 1,000) participate in the program with just under half (45%) achieving the highest rating.[67] Relative to the focus of this study, Texas Rising Star includes, for each age group, guidelines for maximum class sizes and for student-to-teacher ratios (see Table 2.3 in Chapter 2 for a breakdown of the class sizes and student-to-teacher ratios).

## Study Limitations

While guidance exists, rules or laws about prekindergarten class sizes and student-to-teacher ratios in Texas have not yet been established. This study was a requirement of HB 4, commissioned by TEA and DFPS to determine recommendations for the optimal class sizes and student-to-teacher ratios for children in Texas public prekindergarten programs (TEC § 29.1545, 2015). The three strategies for arriving at recommendations including conducting a literature review, examining TEA data on class size and student-to-teacher ratio, and observations in prekindergarten classrooms each have limitations. More detailed limitations are presented in Chapter 2 with each study component; however, some of the limitations the reader should keep in mind include:

- As noted in the literature presented in Chapter 1, many factors affect the quality of prekindergarten programs. This includes, but is not limited to, class size and student-to-teacher ratio. Most research on the quality of prekindergarten programs and student outcomes does not isolate class size and/or student-to-teacher ratios, thus affecting the ability to draw conclusions from the literature review.
- The Early Childhood Data System (ECDS) collected data for the 2014–15 and 2015–16 school years but data submission was voluntary and clear submission of class size and student-to-teacher ratio were not available for these years. Data elements in the ECDS were in the process of being revised during this study to meet the HB 4 requirements. For this report, the study team and TEA agreed on a calculation for class size based on the 2014–15 school year data elements, but this element is expected to be more directly calculated in the future. It was also agreed that the currently available data from ECDS was insufficient to use to calculate student-to-teacher ratios.
- This study was conducted within a four-month timeframe (April 21, 2016 to August 31, 2016) and decisions about study parameters were made accordingly. Most notably, the sample of high-quality prekindergarten programs for observations was based on the best data available on the timeline needed to conduct the study. The assumption was made that elementary schools with the highest average BOY kindergarten progress monitoring scores in 2015–16 were implementing quality prekindergarten programs in 2014–15. Of course, not all children attending kindergarten had necessarily attended prekindergarten and other reasons may explain the high BOY kindergarten progress monitoring scores. Additionally, the observations of the selected

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[64] See https://www.dfps.state.tx.us/child_care/child_care_standards_and_regulations/ for additional information.

[65] See http://qrisnetwork.org/our-framework

[66] The 76th Texas Legislature, Regular Session (1999) also passed HB 3333 requiring local workforce development boards to establish graduated reimbursement rates for subsidized child care based on the TWC's designated vendor program, now known as Texas Rising Star. See http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=76R&Bill=HB3333.

[67] See http://usa.childcareaware.org/wp-content/uploads/2015/10/Texas2.pdf

prekindergarten programs were conducted in spring of the 2015–16 school year based on the assumption that the factors that may have contributed to school readiness in 2014–15 were also in place in 2015–16. Thus, some findings, particularly from the observational analyses, may merit further longitudinal research with a larger observation sample (see Study Limitations subsection within Chapter 2).

## Organization of the Report

The remainder of the report includes study findings (Chapter 2), beginning with findings from the literature review, the extant data analyses, and finally, the observation study of prekindergarten programs. In Chapter 3, the findings are summarized and recommendations made, based on the preponderance of evidence from the three studies regarding guidelines for class size and student-to-teacher ratios.

Additional detail is provided in the appendices. Appendix A provides further detail on study methodology, Appendix B provides an overview of the studies included in the literature review, and Appendix C provides additional tables and figures associated with the extant data and observational studies. Appendices D and E provide vignettes demonstrating quality instructional practices observed in four prekindergarten classrooms and additional information on promising practices observed during prekindergarten classroom observations, respectively.

# Chapter 2: Study Findings

This chapter presents findings from each of the three study components: the literature review, extant data analysis, and observational data analysis.

## Findings from the Literature Review

One of the key strategies for developing recommendations for optimal class sizes and student-to-teacher ratios for prekindergarten programs was to conduct an extensive evidence-focused literature search and review. It is important to point out that prekindergarten-aged children are served in different types of programs including public and private prekindergarten, Head Start, and subsidized child care. While these programs may follow different federal and/or state policies and rules, they all serve the same aged children: three- to five-year-olds. Therefore, this literature review identified best practices and policies across federal and state programs that serve prekindergarten-aged children, including state licensing regulations. (See Appendix A for the methodology of the literature review process for identifying and analyzing sources.)

The literature review is organized under the following headings:

- **Roles of Structural and Process Components in High-Quality Early Childhood Education Programs and their Relationship to Child Outcomes.** This section focuses on what is known about the relationship between specific aspects of early childhood environments and child outcomes.
- **Evaluations of State-Funded Prekindergarten Programs that Include Class Size and Student-to-Teacher Ratio.** This section focuses on evaluations in states other than Texas which have examined the benefits of prekindergarten attendance on child outcomes as well as evaluations that specifically examine the role of class size and student-to-teacher ratios on child outcomes.
- **Class Size and Student-to-Teacher Ratio from National and State Policy Perspectives.** This section highlights current standards from national early childhood organizations as well as specific state guidelines and mandates associated with class size and student-to-teacher ratio.

### Roles of Structural and Process Components in High-Quality Early Childhood Education Programs and their Relationship to Child Outcomes

As noted previously, the structural quality of an early childhood program includes class size, student-to-teacher ratio, teacher qualifications, length of the school day, adoption of a specified curriculum, teacher and staff compensation, and aspects of the physical environment such as square footage of classrooms (Howes, et al. 2008; Mashburn, et al., 2008). Process quality in early childhood refers to the direct experiences children have within the program, such as teacher-student interactions, type of instruction, relationships with parents, and health and safety routines. Research indicates that for children to be ready for school, it takes a combination of structural and process components to create a high-quality out-of-home early childhood education program and assure an environment that provides the stimulation children need to learn.

In the landmark study, Eager to Learn: Educating our Preschoolers (National Research Council, 2001), 17 renowned early childhood researchers over three years conducted an extensive cross-disciplinary review of theory, research, and evaluation in early childhood education. Their findings on class size, student-to-teacher ratio, and child outcomes indicate that "both class size and adult-child ratios are correlated with greater program effects" (National Research Council, 2001, p. 7). Specifically, they found that lower student-to-teacher ratios in early childhood programs were associated with increased teacher-student interactions and individualization, and decreased didactic instruction (i.e., teacher-led lessons where child is expected to listen to learn). Prekindergarten classroom sizes from the studies that were examined ranged from eight to 25 and student-to-teacher ratios ranged from 1:1 to 7:1. However, the researchers concluded that "research is not sufficient to suggest the optimal class size for children at each age" (National Research Council, 2001).

Two other landmark studies, the National Institute for Child Health and Human Development (NICHD) Study of Early Child Care (2014) and The National Day Care Study (1980), provide additional evidence that smaller class sizes and smaller student-to-teacher ratios are associated with positive child outcomes. The NICHD study included 1,364 children from diverse backgrounds in nine states and found that children in classrooms that met the recommended standards for staff child ratios and group sizes had better school readiness and language comprehension and fewer behavior problems at 36 months old (Barnett, Schulman, & Shore, 2004; National Institute of Child Health and Human Development Early Child Care Research Network (1999). Francis (2014) found that children in smaller classrooms (15 versus 20) gained more in literacy skills by the end of preschool.

One of the policy questions examined by The National Day Care Study (1980) was how the daily experiences and development of preschool children attending private day care centers specifically was affected by variations in regulatable center characteristics, such as student-to-teacher ratio, class size, and caregiver qualifications. Of all the regulatable characteristics examined, class size showed the most association with caregiver behaviors and child test scores. The study categorized class sizes or groups as small (2 to 7 children), medium (8 to 12 children), and large (13 or more children) and found that children in small groups exhibited greater gains in receptive language, general knowledge, and verbal initiative and more positive social behaviors. Further, the research showed that teachers in small groups focused more on extending language, mediating children's social interactions, and supporting exploration and problem solving (Barnett, Schulman, & Shore, 2004).

Teachers have also provided their perceptions of how class size and student-to-teacher ratio impact child outcomes. In one study, prekindergarten teachers were asked how they perceived children's social and emotional development in their classrooms. The teachers who were in prekindergarten classrooms with lower student-to-teacher ratios rated the students as more socially competent. Further, teachers reported better social adjustment for children in class sizes of fewer than 20 students, after which the positive effects of class size became negligible (Mashburn, Hamre, Downer, & Pianta, 2006). Teachers have also reported that they were better able to individualize teaching practices when class sizes were smaller (15 versus 20) and use a more child-centered approach to teaching. Having smaller class sizes enabled teachers to get to know their students better and enjoy their jobs more (Francis, 2014).

Some studies, however, argue that certain components of structural quality, including student-to-teacher ratio and class size, do not impact or have very little impact on child outcomes. In one article, the authors contend that the ways in which researchers currently measure early childhood educational environments "…are flawed and that the conclusions drawn about the relationship between these measures and outcomes for children are frequently incorrect or overstated" (Layzer & Goodson, 2006, p.556). The authors categorize measures into three types: measures of structural and environmental characteristics of the care, measures of the process of caregiving, and global measures that combine structural and dynamic aspects of care. Furthermore, they state that all three types of measures have limitations because they usually are one-time snapshots of the care setting; they do not capture the experience of the individual child, and they do not adequately assess informal care settings.

A 2005 study found that structural variables, such as location of the program in a school building, student-to-teacher ratio, and length of day had no relation to quality. However, when considering these results, the authors acknowledge that, "it is not surprising that ratio was unrelated to quality because ratio in these settings was fairly uniform and, on average, low (approximately [7:1])" (Pianta, et al., 2005, p.157).

A study by Mashburn, et al. (2008) did not find a statistically significant relationship between certain standards of quality related to structural features of the programs, including class size and student-to-teacher ratio, and prekindergarten outcomes. The study involved 2,439 children enrolled in 671 prekindergarten classrooms in 11 states. The majority of the programs demonstrated strong structural quality and had small class sizes (82% had 20 or fewer students) and student-to-teacher ratios (87% had 10:1 or lower). However, findings indicate that none of the standards of structural quality, including class size and student-to-teacher ratio, were consistently associated with measures of academic, language, and social development during prekindergarten. Rather, the findings suggest that policies, program development, and professional development efforts that improve teacher-child interactions

facilitated children's school readiness. The authors note that one challenge was that while the sample was large, the range of class size and student-to-teacher ratio was relatively limited which may have contributed to the lack of a relationship between these variables and outcomes of interest.

In sum, the research evidence for causality between class size and student-to-teacher ratio and child outcomes is not sufficient at this time. However, research does indicate that structural features like small class sizes and student-to-teacher ratios create conditions in classrooms in which high-quality social and instructional interactions have a stronger positive effect on children's development. The combination of process and structural components that assures the best outcomes for children bears further research.

## Evaluations of State-Funded Prekindergarten Programs

This section describes evaluations that focus on the benefits of attending prekindergarten programs, those that examine components of high-quality prekindergarten programs that are associated with or positively impact child outcomes, and class sizes and student-to-teacher ratios of the programs.

### EVALUATIONS DEMONSTRATING BENEFITS OF ATTENDING STATE-FUNDED PREKINDERGARTEN PROGRAMS

Several states, such as Tennessee, Oklahoma, New Mexico, New Jersey, Georgia, and North Carolina, have conducted rigorous evaluations of state-funded prekindergarten programs to examine the relationship between prekindergarten programs that implement high-quality standards and student outcomes (Barnett, Schulman, & Shore, 2004; Bartik, 2014; Yoshikawa, et al., 2013; Heckman, Pinto, & Savelyev, 2013). While these state evaluations do not isolate the impacts of class size and student-to-teacher ratio on child outcomes, programs with the most significant and sustained impact had class sizes of 22 or under, small student-to-teacher ratios (11:1 or lower), and certified teachers with experience in prekindergarten (Barnett, Schulman, & Shore, 2004; Bartik, 2014). Table 2.1 provides an overview of state prekindergarten evaluations showing maximum class sizes and student-to-teacher ratios along with a brief descriptions of findings.

**Table 2.1: Summary of Findings from State Prekindergarten Evaluations**

| State (years of evaluation) | Maximum Class Size | Maximum Student-to-Teacher Ratio | Reported Child Outcomes |
|---|---|---|---|
| Oklahoma (2002–03) (Gormley, Gayer, Phillips, & Dawson, 2004) | 20 | 10:1 | Prekindergarten children who attended Tulsa's program and were from economically disadvantaged families entered kindergarten 11 months ahead of children who did not attend prekindergarten as determined by their scores on Woodcock-Johnson Achievement Test (Letter-Word Identification; Spelling; and Applied). |
| New Jersey (Abbott Preschool) (2005–ongoing) (Barnett, Jung, Min-Jong, & Frede, 2013) | 15 | 15:2 | Prekindergarten children showed strong gains upon kindergarten entry in language, literacy, and math. These gains persisted through Grade 2. |
| New Mexico (2006–08) (Hustedt, Barnett, Kwanghee, & Figueras, 2009) | 20 | 10:1 | Children who attended New Mexico prekindergarten demonstrated statistically significant gains in language, literacy, and math compared to children who did not attend this program, as measured on Peabody Picture Vocabulary Test, The Woodcock-Johnson Tests of Achievement, and The Test of Preschool Early Literacy. |
| Tennessee (2009–10 and 2010–11) (Lipsey, Hofer, Dong, Farran, & Bilbrey, 2013) | 20 | 10:1 | Children who attended the Tennessee prekindergarten program experienced a gain in academic skills during the prekindergarten year that was 45% greater than that of the children who did not attend the Tennessee prekindergarten program.* |
| North Carolina (2013–14) (Peisner-Feinberg, Schaaf, Hildebrandt, Pan, & Warnaar, 2015) | 18 | 9:1 | Children who were followed from prekindergarten entry to end of kindergarten showed significant gains over this time period across all domains of learning. |
| Georgia (2012–13) (Schaaf, Peisner-Feinberg, R. LaForett, Hildebrandt, & Sideris, 2014) | 20–22 | 11:1 | Prekindergarten children showed moderate gains on letter knowledge, letter-word identification, phonological awareness, phonemic awareness, math problem-solving, counting, and basic self-knowledge. |

*In a 2015 report updating results from this same longitudinal study in Tennessee, researchers reported that the gains in academic skills that students in the voluntary prekindergarten program realized while in prekindergarten were attenuated by the end of kindergarten. In addition, the study found in 2015 that, "Subsequent positive effects for Head Start children were found on one achievement measure at the end of 1st grade and another measure at the end of 3rd grade (Lipsey, Farran, & Hofer, 2015).

Other studies included exploration of other variables pertinent to this study. Howes, et al., (2008) examined children's growth in school-related learning and social skills in prekindergarten in a sample of state-funded prekindergarten programs in six states. The study examined four structural features: teacher qualifications, location of program (i.e., in a school or other non-school location), length of program (i.e., full-day or half-day), and student-to-teacher ratio. In each state a sample of sites was selected, and one classroom in each site was selected randomly for observation (*n* = 701 classrooms; 2,800 students). This study revealed that while small gains were made across pre-academic and social skills, these gains were attributed more to process features (e.g., teacher-child interactions) rather than structural features, such as class size, teacher qualifications, or program length.

Karoly & Auger (2016) examined studies conducted between 2004 and 2011 in nine states with publicly funded prekindergarten programs. These programs demonstrated at least one statistically significant impact of attendance on a measure of school readiness, which included applied problems, letter word identification, spelling, vocabulary,

and print awareness.[68] Of the four state programs that followed children's progress beyond kindergarten, four found sustained effects on children's learning and development. All of the programs in the study had a maximum class size of 22 students and a maximum student-to-teacher ratio of 11:1. In Tennessee, researchers found that children who participated in the Tennessee Voluntary Prekindergarten Program (TN-VPK) showed a gain in academic skills that was 45% greater than children who did not attend TN-VPK (Lipsey, Hofer, Dong, Farran, & Bilbrey, 2013).

Overall, the evaluations of state-funded prekindergarten programs indicate that attending prekindergarten is associated with better outcomes for children, both academically and socially. In some cases, gains in child outcomes persisted over time and into early grades. Of specific relevance to this study, none of these programs had a class size over 22 or a student-to-teacher ratio over 11:1, although the unique contributions of these two components of quality were not isolated.

### EVALUATIONS IDENTIFYING COMPONENTS OF HIGH-QUALITY PREKINDERGARTEN PROGRAMS

This section describes research that included exploration of variables pertinent to this study beyond state-funded prekindergarten programs.

Minervino (2014) examined four exemplar prekindergarten programs for common structural elements that produced substantial long term benefits for children from economically disadvantaged families. He found that all exemplar programs had at least two adults in the classroom (a lead teacher and a teacher's aide), a maximum class size of 22 students, and a student-to-teacher ratio between 15:2 and 22:2. The study also found that the student-to-teacher ratios found in these programs were especially beneficial for English language learners.

> **Exemplar Prekindergarten Programs (Minervino, 2014)**
> - New Jersey (Abbott Pre-K)
> - Boston (Pre-K)
> - Maryland (Extended Elementary Education Program and "Judy Centers")
> - North Carolina (More at Four)

Wechsler and colleagues' (2016a) analysis of four states building high-quality early education systems —Michigan, West Virginia, Washington, and North Carolina—found that they shared several features. All four states set maximum class sizes at 18-20 and student-to-teacher ratios at 8:1 to 10:1. They also included state prioritization of quality and continuous improvement (e.g., QRIS, linking funding to ratings on QRIS), investing in training and coaching (e.g., providing specialized training accessible to providers), coordinating the administration of birth-through-Grade 3 programs (e.g., sharing data and aligning curriculum and progress monitoring tools), strategically combining multiple funding sources to increase access and improve quality, and creating broad-based coalitions and support (e.g., advocates, politicians, practitioners, business leaders and families). It is worth noting that several aspects of HB 4 are in line with these types of practices.

A recent experimental study of Chicago's prekindergarten program examined the impacts of reducing prekindergarten classroom size from 20 students to 15 students. Prekindergarten teachers that taught both a morning and an afternoon class were included in the study. To examine the impact of classroom size, each teacher and teaching assistant taught one class of 20 students and one class of 15 students. At the end of the prekindergarten school year, students in the smaller classrooms showed gains (albeit modest) in all areas compared to those in the larger classrooms, particularly in the areas of cognitive development and early literacy. Additionally, there was "more communication between teachers and children in reduced class sizes, in the form of teachers giving information or instructions, or clarifying specific things" (Francis, 2014, p. 90).

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[68] Findings associated with several local programs and Head Start were also reviewed with similar findings.

The above studies suggest that when the focus of the research was on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students and student-to-teacher ratios between 8:1 (15:2) and 11:1 (22:2).[69]

## Class Size and Student-to-Teacher Ratio from National and State Policy Perspectives

This section describes guidelines for class sizes and student-to-teacher ratios from national organizations, followed by examples from states.

### NATIONAL ORGANIZATION GUIDELINES

Class size and student-to-teacher ratio guidelines and mandates have been established by many national professional organizations—such as the National Association for the Education of Young Children (NAEYC), American Academy of Pediatrics (AAP), and others—in addition to some states. These organizations' guidelines for recommended class sizes and student-to-teacher ratios are provided in Table 2.2.

**Table 2.2: Guidelines and Mandates for Class Sizes and Student-to-Teacher Ratios for Prekindergarten-Aged Children by National Organizations**

| Organization | Age Groups | Maximum Class Size | Maximum Student-to-Teacher Ratio |
|---|---|---|---|
| National Association for the Education of Young Children (NAEYC)* (National Association for the Education of Young Children, 2016) | 3-year-olds | 18 | 9:1 |
| | 4- and 5-year-olds | 20 | 10:1 |
| National Health and Safety Performance Standards: Guidelines for Early Care and Education Programs (American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education, 2011) | 3-year-olds | 14 | 7:1 |
| | 4- and 5-year-olds | 16 | 8:1 |
| National Accreditation Commission for Early Care and Education Programs (NAC), (National Accreditation Commission for Early Care and Education Programs, 2005) | 4- and 5-year-olds | 20-22, 20-24 | 10-12:1 |
| United Federation of Teachers** (United Federation of Teachers, 2010) | Prekindergarten | 18 | 18:2*** |

*NAEYC provides a range and specific guidelines to accommodate for multiple age grouping. Numbers shown are the maximum student-to-teacher ratio and class size allowed for prekindergarten-age children.
**United Federation of Teachers references prekindergarten in their guidelines but does not specify age. Prekindergarten is typically 4- and 5-year-olds.
***Includes a certified teacher and a paraprofessional.

As shown in Table 2.2, the most stringent guidelines for student-to-teacher ratios (7:1) and class sizes (14) were established by the National Health and Safety Performance Standards (NHSPS) (American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education, 2011). Jointly published by AAP and the American Public Health Association (APHA) in 1992, the goal was to establish stronger standards for out-of-home care, including prekindergarten programs. These standards were revised in 2011 to reflect new research on the health and safety of children in out-of-home care. Class size and student-to-teacher ratio recommendations remained generally unchanged with the exception of lower ratios for infants and toddlers. In their rationale for student-to-teacher ratios, NHSPS states that "for three- and four-year-old children, the size of the class is even more important than ratios. The recommended class size and student-to-teacher staff ratio allow three-to-five-year-old children to have continuing adult support and guidance while encouraging independent, self-initiated play and other activities" (American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education, 2011, p. 5).

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[69] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

The National Center of Education Statistics (NCES) in their annual report, "The Condition of Education, 2016," states that the student-to-teacher ratio averaged across grade levels in public schools declined from 15.9 children to one teacher in 2003 to 15.3 in 2008. In the years after 2008, the average student-to-teacher ratio rose, reaching 16.1 children to one teacher in 2013 (The Condition of Education, 2016). While this information pertains to kindergarten and later grades, it demonstrates that even in higher grades, average student-to-teacher ratios are lower than in some prekindergarten programs. Based on this information, the study team believes that, given that younger children need more supervision, class size and student-to-teacher ratios in prekindergarten should be lower than school age classrooms.

In sum, the national guidelines for maximum class size and student-to-teacher ratios vary by age group and organization (3 years and 4 to 5 years) and are between 14 and 24 for class size and 7:1 and 12:1 for student-to-teacher ratios.

### TEXAS POLICIES AND GUIDELINES FOR CLASS SIZE AND STUDENT-TO-TEACHER RATIO

Within the state of Texas, several programs that serve prekindergarten-age children have either required or recommended guidelines for class sizes and student-to-teacher ratios. These class sizes and student-to-teacher ratios are included in Table 2.3 for a comparative analysis and include:

- The Head Start Program Performance Standards (HSPPS) (42 U.S.C. 9801 et seq.1306.42) (Administration for Children and Families, 2008);
- DFPS – CCL Minimum Standards for center-based and home-based programs (Texas Department of Family and Protective Services, 2015); and
- Texas Rising Star which serves as the program standards and criteria for Texas's QRIS system, a voluntary system used by subsidized early education programs in Texas. Programs that are nationally accredited by one of the national organizations such as NAEYC or NAC, are automatically rated as a four-star program.

> "A Texas Rising Star provider is a child care provider that has an agreement to serve Texas Workforce Commission (TWC)-subsidized children and that voluntarily meets requirements that exceed the State's Minimum Child Care Licensing (CCL) Standards" (Texas Workforce Commission, 2015, p.1.1).

TEA oversees public prekindergarten in Texas, which does not fall under the regulatory authority of the DFPS minimum standards; however, some Texas public prekindergarten programs do obtain a DFPS-CCL license primarily to have access to federal Child Care and Development Block Grant funds. When a public prekindergarten program under the jurisdiction of an Independent School District (ISD) is licensed by DFPS-CCL, they may not exceed CCL class size and student-to-teacher ratios at any time.[70] TEA does encourage local education agencies to maintain and not exceed the 22:1 student-to-teacher ratio required for kindergarten through Grade 4. Additionally, public prekindergarten programs awarded funding under the new High-Quality Prekindergarten Grant program must attempt to not exceed an 11:1 student-to-teacher ratio. As shown in Table 2.3, the DFPS minimum standards for Texas early childhood education programs also vary by age group and allow for a maximum group (class) size of 35 and a maximum student-to-teacher ratio of 22:1.

### STUDENT-TO-TEACHER RATIO AND CLASS SIZE IN STATE PREKINDERGARTEN PROGRAMS

According to the National Institute for Early Education Research (NIEER) *State of Preschool 2015* report (Barnett, et al., 2016) that reviews states' public prekindergarten programs according to 10 research-based quality standards, 86% of all states met the quality standard for class sizes of 20 children or fewer and 88% met the quality standard of 1 adult for every 10 children. According to NIEER, Texas does not meet either of these standards.

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[70] ISDs can have collaborations or memoranda of understanding (MOUs) with private providers for prekindergarten, and when programs collaborate, they follow the CCL ratio rules.

**Table 2.3: Mandates and Guidelines for Class Sizes and Student-to-Teacher Ratios for Prekindergarten-Aged Children by Early Education Programs in Texas**

| Early Childhood Education Program | Age Groups | Maximum Class Size | Maximum Student-to-Teacher Ratio |
|---|---|---|---|
| Head Start (Federal Guidelines) (2008) – mandate | 3–5 year-old | 20 | 10:1 |
| Texas Rising Star – Score 0* (2015) | 3 year-old | 18 | 15:1 |
| Texas Rising Star – Score 0 | 4 year-old | 21 | 18:1 |
| Texas Rising Star – Score 0 | 5 year-old | 25 | 22:1 |
| Texas Rising Star – Score 1 | 3 year-old | 18 | 12:1 |
| Texas Rising Star – Score 1 | 4 year-old | 21 | 14:1 |
| Texas Rising Star – Score 1 | 5 year-old | 25 | 16:1 |
| Texas Rising Star – Score 2 | 3 year-old | 18 | 11:1 |
| Texas Rising Star – Score 2 | 4 year-old | 21 | 12:1 |
| Texas Rising Star – Score 2 | 5 year-old | 25 | 13:1 |
| Texas Rising Star – Score 3 | 3 year-old | 18 | 9:1 |
| Texas Rising Star – Score 3 | 4 year-old | 21 | 10:1 |
| Texas Rising Star – Score 3 | 5 year-old | 25 | 10:1 |
| Texas Child Care Licensing (Texas Department of Family and Protective Services Child Care Center Minimum Standards) – mandate for licensed family child care and licensed centers | 3 year-old | 30 | 15:1 |
| | 4 year-old | 35 | 18:1 |
| | 5 year-old | 35 | 22:1 |

Source: Texas Workforce Commission (2015). Texas Rising Star Child Care Provider Certification Guidelines, Revised 2015.
https://texasrisingstar.org/wp-content/uploads/2015/03/Texas-Rising-Star-Certification-Guidelines-3.27.15.pdf
*Texas Rising Star Student-to-teacher ratios are based on a point system with more points assigned to meeting higher quality guidelines (0 to 3 points). Class size, however, is required.

Table 2.4 shows information from *The State of Preschool* (2015) on prekindergarten programs in states comparable to Texas in population size, including requirements for class sizes and student-to-teacher ratios (Note: the class sizes and student-to-teacher ratios presented in the table are requirements and not optional). Additionally, the funding per child and length of the program is included to show the cost within these states to implement the programs on a large scale.

**Table 2.4: Required Class Size, Student-to-Teacher Ratio, State Spending per Child, Prekindergarten Population, and Length of Programs in States Comparable to Texas Based on 2015 Data**

| State | Class Size | Student-to-Teacher Ratio | State Spending per Child Enrolled* | Prekindergarten Population Enrolled (3 and 4 year-olds) | Length of Program |
|---|---|---|---|---|---|
| Texas | no limit | no limit | $3,584*** | 218,410 | 3 hours/day, 5 days/week, academic year |
| Florida (4-year-olds only) | 12 (summer); 20 (school year) | 12:1 (summer); 10:1 or 20:2 (school year) | $2,304 | 166,522 | determined locally |
| New York | 20 (both 3- and 4-year-olds) | 8:1 (3-year-olds); 9:1 (4-year-olds) | $6,617 | 112,120 | 2.5 hours/day, 5 days/week, academic year |
| California | no limit | 8:1 | $4,694 | 130,362 | 3 hours and 59 minutes/day, 5 days/week, determined locally |
| Tennessee** | 16 (3-year-olds) 20 (4-year-olds) | 8:1 (3-year-olds) 10:1 (4-year-olds) | $5,219 | 16,274 | 5.5 hours/day, 5 days/week, academic year |

Source: *The State of Preschool 2015.* Barnett et al. (2016).
*Not adjusted for cost of living.
**Although not comparable in prekindergarten population size, Tennessee is included in the table because it had conducted a rigorous evaluation of their prekindergarten programs and specifically address student-to-teacher ratios and class sizes.
***Not inclusive of grant funding.

Additionally, a report by Wechsler, et al. (2016a), provides a summary of data in four states that appear to be on the path to supporting high-quality prekindergarten statewide. While these states are not similar in population to Texas, the maximum class size and student-to-teacher ratios are similar to those required by comparable states (see Table 2.4) as listed below:

- Michigan: class size 18; student-to-teacher ratio 8:1
- North Carolina: class size 18; student-to-teacher ratio 9:1
- West Virginia: class size 20; student-to-teacher ratio 10:1
- Washington: class size 20; student-to-teacher ratio 10:1

## Literature Review Conclusion

The literature review examined (i) research on the roles of structural and process components in high-quality early childhood education programs and their relationship to child outcomes, (ii) evaluations of state-funded prekindergarten programs, and (iii) national and state mandates and guidelines for class sizes and student-to-teacher ratios.

Research indicates that for children to be ready for kindergarten (physically, socially, cognitively, etc.) and to be successful in school, it takes a combination of structural and process components to create a high-quality early childhood education program. To date, research has not been able to establish causality between class size and student-to-teacher ratio and child outcomes. However, research does indicate that structural features like small class sizes and student-to-teacher ratios create conditions for high-quality social and instructional interactions in the classroom that contribute to positive child outcomes. The combination of process and structural components that assures the best outcomes for children bears further research.

Overall, the evaluations of state-funded prekindergarten programs indicate that children who attended prekindergarten versus those who did not had better outcomes, both academically and socially, that sustained over time. Of specific relevance to this study, none of these programs had a class size over 22 or a student-to-teacher ratio over 11:1, although the unique contributions of these two components of quality were not isolated. When the focus of the research was on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students and student-to-teacher ratios between 8:1 (15:2) and 11:1 (22:2).[71]

The national guidelines for maximum class size and student-to-teacher ratios vary by age group and organization (3 years and 4 to 5 years) and are between 14 and 24 for class size and 7:1 and 12:1 for student-to-teacher ratio. The DFPS minimum standards for Texas early childhood education programs also vary by age group and allow for a maximum group (class) size of 35 and a maximum student-to-teacher ratio of 22:1.

The *State of Preschool 2015* reported that 86% of all states met the quality standard for class sizes of 20 children or fewer and 88% of states met the quality standard of 10 children for 1 adult per classroom (Barnett et al., 2016). Other states reported class sizes between 18 and 20 and student-to-teacher ratios between 8:1 and 10:1.

In conclusion, the literature review suggests that smaller class sizes (no more than 22) and lower student-to-teacher ratios (no more than 11:1) are associated with higher classroom quality, better student-to-teacher relationships and interactions, and improvement in children's academic and social skills. Additionally, smaller class sizes and student-to-teacher ratios appear to be common characteristics of programs determined to be of high-quality. It is also important to note that class size and student-to-teacher ratio are only two of the several components of a high-quality, developmentally appropriate program and that simply lowering the class size and student-to-teacher ratio

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[71] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

without addressing other components, such as teacher qualifications and student-to-teacher interactions, may not increase school readiness in prekindergarten children.

A handful of studies with mixed results or null findings draws attention to gaps in the research and the complexity of studying this issue. A paucity of rigorous, controlled experiments makes it challenging to draw definitive conclusions about a causal relationship between class size, student-to-teacher ratio, and prekindergarten child outcomes. While evidence exists that indicates that smaller class sizes and student-to-teacher ratios, in addition to other variables of quality, can impact child outcomes, more precise experimental research that can isolate causal relationships would benefit the field.

## Texas Data on Prekindergarten Class Size and Student-to-Teacher Ratio

The second component of the study was utilized to understand the current status of class size and student-to-teacher ratios in prekindergarten programs in Texas (Research Question 1). As noted in Chapter 1, Texas does not currently have rules or laws on either class size or student-to-teacher ratio for prekindergarten classrooms, but does provide guidance that prekindergarten programs not exceed the current guidance for kindergarten through Grade 4 of a class size of 22 students (22:1 ratio) and the High-Quality Prekindergarten Grant program suggests programs receiving this grant attempt to maintain an 11:1 student-to-teacher ratio. Recommendations suggested by this report will be better informed by the reality of how Texas school districts currently address the issues of class size and student-to-teacher ratios. In addition, if recommendations were proposed that differ substantially from the existing Texas context, other factors may need to be considered (e.g., funding implications for classrooms and/or teachers).

Extant data were provided from two TEA data systems for this analysis: ECDS and PEIMS.[72] The extant data provided by TEA used to calculate public prekindergarten class size were from the 2014–15 school year as 2015–16 school year data were not available in time for inclusion in this study. Basic detail on methods is provided in this chapter with additional detail on methods provided in Appendix A.

### Limitations

The following limitations should be kept in mind in understanding the examination of extant Texas data:

- In the 2014–15 school year, districts were required to report in PEIMS data elements to the agency. However, reporting prekindergarten data into the new ECDS was still voluntary. Districts voluntarily participating in submitting public prekindergarten data into ECDS may not be representative of those choosing not to enter this data. Beginning in the 2016–17 school year, reporting public prekindergarten data into ECDS will be required.
- Prekindergarten data elements in the ECDS were in the process of being revised at the time of this study with the new specifications published in July 2016.[73] While the study team and TEA agreed on a calculation for class size based on the available 2014–15 school year ECDS data elements, it was agreed that the data from ECDS from the 2014–15 school year were insufficient to use to calculate student-to-teacher ratios, although this was a primary focus of the study. The data elements needed to calculate each of these measures precisely were added in the July 2016 revision.[74]
- Data reporting errors may not have been identified in the ECDS for the 2014–15 school year due to a lack of systematic data validation built into the system. Data validation checks are part of the 2016–17 ECDS revisions.

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[72] For additional information on ECDS see http://www.texasstudentdatasystem.org/TSDS/Education_Data_Warehouse/Core_Collection/Early_Childhood_Data_System/. For additional information on PEIMS please see http://tea.texas.gov/Reports_and_Data/Data_Submission/PEIMS/PEIMS_-_Overview/.

[73] A revised data standards document was published by TEA in July 2016 for use in the 2016–17 school year. See http://castro.tea.state.tx.us/tsds/teds/2017A/Section102016_2017.pdf

[74] For example, teacher of record, assistant teacher and support teacher information will all be collected. See http://castro.tea.state.tx.us/tsds/teds/2017A/Section102016_2017.pdf

## Texas Education Agency Data Sources

The study team utilized available data from two TEA extant data sources for this study: ECDS and PEIMS.

### EARLY CHILDHOOD DATA SYSTEM

Per TEC § 29.161 (2015), the ECDS is a new reporting system used for the first time in the 2014–15 school year to collect prekindergarten and kindergarten data including student demographics, program instruction type (e.g., full-day, half-day), academic information (e.g., kindergarten school readiness progress monitoring results), and teacher information (e.g., teacher name).[75] The data used in the analysis for this component of the study included teacher and student data and instruction type.[76]

The data available in ECDS were somewhat limited for the purposes of this study in the following ways:

- While ECDS data contained a teacher record linked to each student, districts were not asked to enter all teachers and education assistant records associated with the student. Therefore, the number of adults in a classroom could not be determined, making it impossible to reliably calculate student-to-teacher ratios.
- A classroom-to-teacher link (or classroom ID) to generate class size was not available. Therefore, classroom size was calculated by associating teachers and students. This required making data processing decisions for handling the data (see Appendix A).
- Reporting was voluntary for districts with only approximately 18% of school districts reporting data for prekindergarten in the 2014–15 school year.

Given these limitations, class sizes—and not student-to-teacher ratios—for those public prekindergarten programs that submitted data were the focus of analyses for this study. Beginning in the 2016–17 school year, several changes will occur to the ECDS data system that will facilitate further study on class sizes and student-to-teacher ratios in public prekindergarten programs across the state. All districts will be required to report to TEA additional data elements for public prekindergarten programs at the district and campus level through a PEIMS/ECDS hybrid collection as part of the broader Texas student data system.[77] Improved collection methods will also eliminate duplication in data entry and result in more robust data entry. Existing and new data elements to be reported beginning in the 2016–17 school year will provide the following:

- demographic information on students enrolled in district prekindergarten classes, including the number of students who are eligible for classes under TEC § 29.153 (2015),
- the numbers of half-day and full-day prekindergarten classes offered by the district and campus,
- the sources of funding for the prekindergarten classes,
- class size,
- instructional staff-to-student ratio and the ability to link students to teachers,
- the type of curriculum, and
- the type of prekindergarten progress monitoring tool and results (if administered).

### PUBLIC EDUCATION INFORMATION MANAGEMENT SYSTEM

All Texas school districts are required to submit a broad range of administrative data to TEA including student demographic and attendance data, personnel data, financial data, and organizational information. These data are housed in PEIMS. However, as was also the case for ECDS, data elements were not available that could be used to calculate student-to-teacher ratio for prekindergarten classrooms. In addition, the data elements necessary to reliably

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[75] ECDS replaced the Kindergarten Readiness System at this time.

[76] See http://castro.tea.state.tx.us/tsds/teds/2013F/v1.0/ds10/teds-ds10.ecdsv1.0.pdf and http://www.texasstudentdatasystem.org/TSDS/TEDS/1415A/TEDS_Section_10_-_TSDS_Core_Collections/ for the 2014–15 ECDS data standards.

[77] See http://castro.tea.state.tx.us/tsds/teds/2017A/Section102016_2017.pdf and http://www.texasstudentdatasystem.org/

calculate prekindergarten class size (e.g., information regarding program instruction type) were not available in PEIMS. The PEIMS data were used in this analysis to compare the demographics of the ECDS sample from districts that voluntarily submitted to the state to all prekindergarten students. This comparison provided insight into the representativeness of ECDS data relative to the prekindergarten population in Texas.

## Data Analysis

Prior to analyzing the data, the study team cleaned the data and calculated class size. Next, preliminary descriptive analyses and comparisons across the extant data files were conducted. See Appendix A for additional details.

### DATA CLEANING AND CLASS SIZE CALCULATION

Given the noted limitations of the ECDS data, the data were cleaned to remove data that would impact a reliable calculation of class size. With approval from TEA, the study team examined the data for cases with insufficient or missing data elements needed to calculate class size and excluded these cases (see the cleaning notes in Appendix A for additional details). After the ECDS data had been cleaned, a total of 50,397 students, approximately 86% of the original ECDS data, were included in the final sample for analyses.

Following data cleaning, class sizes for prekindergarten programs that had data available in ECDS were calculated. Specifically, class size was defined as the number of students associated with the same teacher or the same group of teachers.[78] The ECDS indicator of instruction type also factored into the class size calculation. Within ECDS, instruction type is categorized as being a full-day program, a half-day morning program, and/or a half-day afternoon program. The study team created a fourth instruction type referred to as mixed instruction program. Within the mixed instruction category, some of the students had attended full-day classes while others attended the same class but only for a half day. Appendix A provides additional detail about the class size calculation.

## Results

### EARLY CHILDHOOD DATA SYSTEM

**Class Size.** The study team conducted descriptive analyses on class size based on the ECDS 2014–15 school year data. The average class size in this sample was 16.6 students (Table 2.5). Approximately 25% of all classes had fewer than 13 students while 25% had more than 21 students. At the extremes for class size, approximately 5% of all classes had 1-2 students and another 5% had more than 25 students.

A total of 72% of the Texas public prekindergarten classrooms for whom ECDS 2014–15 school year data were provided fell at or below a class size of 20 (i.e., the quality standard used by NIEER for reviewing states' public prekindergarten programs). An additional 15% had 21 to 22 students. This means that the class size in 87% of Texas public prekindergarten classrooms for whom ECDS 2014–15 school year data were provided was at or below 22 students, as recommended by TEA. Of the remaining 13% of public prekindergarten classrooms, 11% had a class size between 23 and 30 students while 2% had class sizes greater than 30 students with the maximum class size calculated as 61 students. One explanation for the instances of very large classes is that they were the result of data entry errors. It is also possible that even following data cleaning rules and the steps to calculate class size, some class sizes were inaccurately calculated following these rules. The new data elements and data validation checks that will be included in the 2016–17 collection should allow class size (and student-to-teacher ratios) to be calculated with greater precision in future years.

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[78] There were a small number of cases in which districts reported in multiple teachers instead of a single teacher of record, these cases were kept if it could be reliably determined that these teachers were associated with the same group of students and students were always associated with this same group of teachers.

**Table 2.5: Texas Public Prekindergarten Class Size, 2014–15**

| Characteristic | Value |
|---|---|
| Number of Districts | 158 |
| Number of Campuses | 773 |
| Number of Classes | 3,012 |
| Average | 16.6 |
| Standard Deviation | 7.1 |
| Median | 17.0 |
| Mode | 17.0 |
| Minimum | 1.0 |
| Maximum | 61.0 |
| 5th Percentile | 2.0 |
| 25th Percentile | 13.0 |
| 75th Percentile | 21.0 |
| 95th Percentile | 25.0 |

Source: Early Childhood Data System, 2014–15

As noted, instruction type was included in the calculation of class size. Table 2.6 provides an overview of class size by instruction type (i.e., full-day program, half-day morning, half-day afternoon, or mixed) based on the ECDS data for the 2014–15 school year. Nearly half (49%) of the classrooms were full-day programs. The full-day programs had a relatively higher average class size (18.3 students) than the other instruction types, while the half-day afternoon programs had the smallest average class size (13.8 students).

**Table 2.6: Texas Public Prekindergarten Class Size by Instructional Type, 2014–15**

| Instruction Type | Number of Classes Included | | Class Size | | | | |
|---|---|---|---|---|---|---|---|
| | n | % | Average | Standard Deviation | Mode | Minimum | Maximum |
| Full-Day Program | 1,478 | 49.1% | 18.3 | 6.8 | 20.0 | 1.0 | 61.0 |
| Half-Day Morning Program | 879 | 29.2% | 15.5 | 7.9 | 16.0 | 1.0 | 57.0 |
| Half-Day Afternoon Program | 503 | 16.7% | 13.8 | 5.3 | 14.0 | 1.0 | 33.0 |
| Mixed (classes combining full-day students with half-day students)* | 152 | 5.0% | 17.2 | 5.9 | 18.0 | 2.0 | 43.0 |
| **Overall** | **3,012** | **100%** | **16.6** | **7.1** | **17.0** | **1.0** | **61.0** |

Source: Early Childhood Data System, 2014–15
*For the Mixed category, class size was estimated by the potential maximum number of students during the day.
Note: Class sizes were calculated based on number of students in each instruction type. See Appendix A for additional information.

### REPRESENTATIVENESS OF THE EARLY CHILDHOOD DATA SAMPLE

As noted, one challenge with the class size analyses was that only a small percentage of districts (18%) voluntarily reported data into ECDS in the 2014–15 school year. Eighty-six percent of that data was included in the class size analyses but 14% was excluded based on data cleaning rules, further limiting the sample. To address concerns about the representativeness and potential generalizability of the ECDS sample to the broader population of Texas public prekindergarten programs, the study team explored whether the ECDS sample was similar to the entire population of public prekindergarten students in Texas during the same year (2014–15) in terms of student demographics and geographic regions (see Table 2.7). PEIMS data includes student demographic data for all students in Texas public schools, including prekindergarten students. The assumption was that if the student demographics of the ECDS sample were similar to the student demographics of the PEIMS data, then that may suggest that the information on class size from ECDS can be generalized to the larger population of all Texas public prekindergarten programs.

**Table 2.7: Comparison of Student Demographic Data for the Class Size Sample and All Texas Public Prekindergarten Programs, 2014–15**

| Characteristic | Data Sources | |
| --- | --- | --- |
| | All Texas Public Schools (PEIMS 2014–15) | ECDS Sample (2014–15) |
| Number of Districts | 1,052 | 158 |
| Number of Campuses | 3,297 | 773 |
| Number of Students[a] | 236,408 | 50,397 |
| Average Age | 3.9 | 4.3 |
| % Female | 49.8% | 49.9% |
| % Male | 50.2% | 50.1% |
| % Hispanic | 63.7% | 67.1% |
| % Economically Disadvantaged | 87.2% | 88.4% (missing $n$ = 26) |
| % English Language Learners | 39.8% | 41.9% (missing $n$ =3) |
| % Special Education | 5.5% | 6.1% |

Source: Early Childhood Data System (ECDS), 2014–15; Public Education Information Management System (PEIMS), 2014–15
[a]The PEIMS number of students reported in this table is from the end-of-year PEIMS collection which includes all students ever attending over the course of the school year. The number of prekindergarten students reported elsewhere in the report differs slightly and is based on PEIMS enrollment data collected in the fall. The end-of-year collection was chosen for this calculation to better align with the timing of the ECDS collection which occurred in the spring of 2014–15.

PEIMS data indicate that in the 2014–15 school year, 3,297 Texas public school campuses in 1,052 school districts provided prekindergarten programs, enrolling 236,408 prekindergarten students (Table 2.7). In comparison, 21% of all prekindergarten students at 15% of all districts (23% of all campuses) with prekindergarten programs were represented in the cleaned ECDS 2014–15 school year sample. The average age of students as of September 1, 2014 (start of the school year) was similar between the ECDS sample and the PEIMS population; students in the ECDS 2014–15 school year sample were slightly older than four (4.3 years old) while the average for all public prekindergarten student in PEIMS was slightly younger than four (3.9 years old). In terms of student demographics, the ECDS sample was also very similar to the PEIMS population. A similar but slightly higher percentage of prekindergarten students in the ECDS sample were identified as Hispanic (67% and 64%, respectively) as compared to all prekindergarten students in the state. This difference was three percentage points while the difference between the ECDS sample and PEIMS was smaller for all other demographics. Geographically, the ECDS sample included data from 18 of the 20 regional education service centers (ESCs), meaning that the ECDS sample included representation from almost all ESC regions across the state.[79]

Overall, the analysis suggests that the ECDS 2014–15 sample was representative of the total population of public prekindergarten students in Texas, which suggests that findings on class size estimated from this sample may generalize to Texas public prekindergarten programs. Still, representativeness on data not collected by both systems (or by either system) remains unknown which could limit the generalizability of the findings.

## Extant Data Conclusions

Based on a representative sample of school districts reporting prekindergarten data into ECDS during the 2014–15 school year, the average class size (17 students) was within national and Texas guidelines for quality programs. A majority of classes (72%) had a class size at or below a class size of 20 (i.e., the quality standard used by NIEER for reviewing states' public prekindergarten programs). Even more (87%) had class sizes of 22 students or fewer, meeting or exceeding the TEA guideline to not exceed a class size of 22 and aligning to findings from the literature review for maximum class sizes to not exceed 22 students. Fewer than 2% of class sizes exceeded 30 students. Due

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[79] The two ESC regions not represented were Region 8 Mt. Pleasant and Region 9 Wichita Falls. See http://tea.texas.gov/regional_services/esc/ for information on the education service centers.

to lack of available data, the study team was unable to calculate student-to-teacher ratios of Texas public prekindergarten programs; therefore, recommendations for student-to-teacher ratios cannot be made using this data.

## Observation Study of Prekindergarten Programs in Texas

To support the recommendations regarding optimal class sizes and student-to-teacher ratios for prekindergarten classes, the third study component involved observations of prekindergarten classes across the state of Texas. The study team observed the selected classrooms using the Classroom Assessment Scoring System for Prekindergarten (CLASS® PreK) to assess quality.[80] The purpose of the observations was two-fold. In order to inform recommendations, the study team examined the relationship between the two structural features of interest (class size and student-to-teacher ratio) and CLASS PreK quality scores (overall and in specific domains). Next, examples of best or promising practices from prekindergarten classrooms rated highly on the CLASS PreK from across the sample are provided in the context of class size and student-to-teacher ratio. Additional information about methods for the observational study can be found in Appendix A.

### CLASS PreK Observation Protocol

CLASS PreK was selected for use to assess classroom quality during the observations. CLASS PreK is an observation tool that measures the classroom interactions that have been associated with improvements in student learning in prekindergarten classrooms. [81] It has been used extensively for both research and professional development (PD) purposes. Additionally, data from CLASS PreK observations have been used to set school-wide goals and shape system-wide policy at the local, state, and national levels. Based on research from the University of Virginia's Curry School of Education and studied in thousands of classrooms nationwide, CLASS PreK:

- Focuses on effective teaching;
- Helps teachers recognize and understand the power of their interactions with students;
- Aligns with professional development tools; and
- Works across age levels and subjects.

For this study, the CLASS PreK was used as the observation tool to measure early childhood classroom quality by focusing on adult-child interactions across three primary domains: Emotional Support, Classroom Organization, and Instructional Support (see Table 2.8 for the three domains and the respective dimensions measured using the CLASS PreK observation tool). Trained observers utilized a seven-point scale to rate student-to-teacher interactions on ten different dimensions: (1) four Emotional Support dimensions, (2) three Classroom Organization dimensions, and (3) three Instructional Support dimensions. See Appendix A for more information about the CLASS PreK domains and dimensions.

**Table 2.8: CLASS PreK Observation Tool: Domains and Dimensions**

| Domains | Dimensions |
|---|---|
| Emotional Support | Positive Climate<br>Negative Climate<br>Teacher Sensitivity<br>Regard for Student Perspective |
| Classroom Organization | Behavioral Management<br>Productivity<br>Instructional Learning Formats |
| Instructional Support | Concept Development<br>Quality of Feedback<br>Language Modeling |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015)

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[80] See http://teachstone.com/classroom-assessment-scoring-system/age-levels/age-levels-pre-k/
[81] *Ibid*

## Limitations

When reviewing the findings presented in this section, the following limitations related to the site selection and observational data should be taken into account:

- The initial selection of sites to be included in the observation sample was limited to only those districts which submitted ECDS 2014–15 prekindergarten enrollment data and 2015–16 beginning of year progress monitoring data for kindergarten students. This substantially limited the number of public prekindergarten programs that could be selected for observation relative to all programs in the state since ECDS prekindergarten data submission for 2014–15 was voluntary.
- As previously noted in the examination of extant data, ECDS data appropriate for calculating student-to-teacher ratios were not available. Student-to-teacher ratios at the observed sites were unknown until the time of the observation. This constraint limited the study team's ability to stratify the sample by class size or student-to-teacher ratio, which may have aided in the subsequent analyses comparing quality as measured by CLASS PreK by class size and student-to-teacher ratio.
- The statute called for observations of best practices and examples from effective prekindergarten programs across the state (see section on Site Selection for additional information). Briefly, kindergarten campuses were rated on quality based on ECDS 2015–16 school year BOY kindergarten progress monitoring data and the assumption was made that one contributor to higher levels of kindergarten (school) readiness was high-quality prekindergarten programs. Given that not all children who attend kindergarten attended prekindergarten public school at the same campus (and some students may not have attended any early childhood program outside the home), it is possible that some campuses selected for observation were not actually high-quality.[82]
- Even if all students did attend a campus's prekindergarten program, students' performance on BOY kindergarten progress monitoring was also potentially influenced by many other important factors (e.g., teacher quality, school environment, family socioeconomic status), which was not considered in the site selection process due to unavailable data.
- Different types and versions of kindergarten progress monitoring tools were used by schools, which had varying standards and definitions for school readiness.[83] In addition, the kindergarten progress monitoring data were collected at the beginning of kindergarten after students had completed prekindergarten. There was no comparable prekindergarten BOY progress monitoring data that could be used to determine if students in these programs started prekindergarten at a higher level relative to students not attending one of the observation site programs.
- Classroom observations occurred in May 2016 (i.e., during the 2015–16 school year). The assumption was made that the prekindergarten program maintained high quality into the 2015–16 school year. However, organizational, instructional, and staffing factors which may have contributed to quality as indicated by students' school-readiness from 2014–15 to 2015–16 may not have be in place in 2015–16. The timeline of the current study did not allow for following the 2015–16 prekindergarten students into kindergarten during the 2016–17 school year to examine if school readiness was maintained at high levels.
- Scheduling and conducting classroom observations were done on a tight timeline in the final month before the school year ended (May 2016), including one full week when no observations were conducted due to state testing (May 9–13). Observations conducted at the very end of the school year, particularly the final week of school, may not be reflective of the teaching and learning that took place in those classrooms earlier in the spring 2016 semester.
- The student-to-teacher ratio and class size analyses included in this section examine the relationship between class size, student-to-teacher ratios, and CLASS PreK observation scores without controlling for teacher characteristics. That is, observation scores for a classroom may be related to the background, training, and pedagogical skills of teachers, rather than the student-to-teacher ratio or the class size. It is also possible that

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[82] Student level school readiness data became available after completion of site selection and are presented in later sections (see Table 2.10).
[83] All of the progress monitoring tools were approved by TEA for the purposes of assessing kindergarten readiness.

some of the observation sub-scores (e.g., productivity) may not be related to student-to-teacher ratios or class size.

▪ Lastly, conclusions about the relationship between class size, student-to-teacher ratio and CLASS PreK observation scores should be viewed with caution due to the relatively small number of classroom observation sample (*n* = 97 classrooms from 32 campuses in 16 districts). This caution is further extended to analyses which further segment the 97 observations based on student-to-teacher ratios (e.g., comparison of 64 classrooms with 15:1 ratios or lower to 23 classrooms with ratios of 16:1 or more). The findings observed in this sample for a given class size group or student-to-teacher ratio may not be generalizable to all classrooms with the same characteristics.

## Data Collection

The study team conducted a total of 97 prekindergarten classroom observations between May 3–27, 2016. As Figure 2.1 illustrates, observations were conducted in six different geographic regions of the state, with the largest number of observations taking place in Central Texas (*n* = 29), followed by Houston/Gulf Coast (*n* = 28), South Texas/Rio Grande Valley (*n* = 15), and the Dallas-Fort Worth metropolitan area (*n* = 14). Observations were conducted in 32 different campuses across 16 different districts or charter school organizations. (See Appendix B, Table B.1.)

**Figure 2.1: Geographic Distribution of Prekindergarten Classroom Observations, 2016**
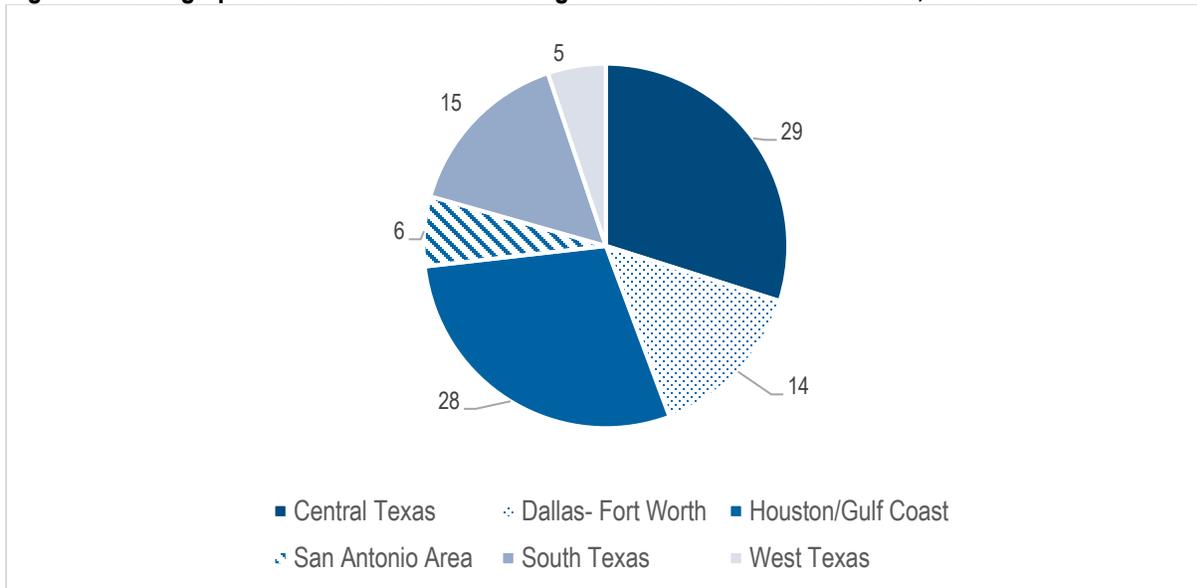


Source:    Observations of Texas public prekindergarten classrooms, May 2016
Note: *N* = 97 classrooms from 32 campuses in 16 districts included in the observation study.

### SITE SELECTION

In order to identify effective prekindergarten programs for observation, per TEC § 29.1545 (2015), a statewide sample of prekindergarten programs was drawn based on aggregated campus-level ECDS 2015–16 BOY progress monitoring kindergarten data.[84] The study team used this extant data to identify prekindergarten program campuses whose kindergarten students were high performing relative to students attending other campuses. Then, the campuses were stratified according to geographic region (i.e., Dallas/Fort Worth, Houston/Gulf Coast, South Texas, Central Texas, San Antonio/Corpus Christi, and West Texas). Within each region, campuses were ordered from highest to lowest on quality based on the BOY data, and after the final sample was selected, the sample included

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[84] Due to the tight timeline associated with selecting campuses for classroom observations, scheduling observations with campuses, and conducting observations before the end of the 2015–16 school year, the evaluation team had to rely on aggregate campus-level data.

campuses with scores in the top 24-27% for their region. This group was then limited to campuses that had submitted ECDS 2014–15 prekindergarten data to ensure that the campus was linked with a public prekindergarten program. Finally, campuses within this group with three or more prekindergarten teachers were prioritized for selection, and logistics including proximity of high quality campuses were used to finalize selection.[85]

### DESCRIPTIVE PROFILES OF CAMPUSES INCLUDED IN PREKINDERGARTEN OBSERVATIONS

To shed light on the generalizability of findings from sites included in the classroom observation sample, the study team conducted several analyses to generate high-level student demographic characteristics of the observed sites and review whether the observed sites were similar to the overall Texas public prekindergarten population. Table 2.9 shows how the selected observation sites compared to the 2014–15 ECDS prekindergarten population and to the overall Texas public prekindergarten population. The observed sample included a smaller percentage of students identified as Hispanic, although this was still the majority of students (54% in observed as compared to 64% statewide and 67% in ECDS sample). The percentages of students identified as economically disadvantaged and students classified as English language learners were similar across the groups. The observed sample had half as many students identified as having special education needs as did the public prekindergarten students statewide or in the ECDS sample (see Appendix A for the methodology used for these analyses). While generally differences were small enough to suggest the observed sites were representative, the observed sites may not represent prekindergarten programs serving students identified with special education needs in particular.

**Table 2.9: Comparison of Student Characteristics in Observed Sites and Texas Public School Prekindergarten Programs and Students**

| Characteristics | Data Sources | | |
| --- | --- | --- | --- |
| | All Texas Public Schools (PEIMS 2014–15) | ECDS Sample (ECDS 2014–15) | Observed Sites (PEIMS 2015–16) |
| Number of Districts | 1,052 | 158 | 16 |
| Number of Campuses | 3,297 | 773 | 32 |
| Number of Students | 236,408 | 50,397 | 2,480 |
| Average Age | 3.9 | 4.3 | 3.8 |
| % Female | 49.8% | 49.9% | 49.9% |
| % Male | 50.2% | 50.1% | 50.1% |
| % Hispanic | 63.7% | 67.1% | 54.4% |
| % Economically Disadvantaged | 87.2% | 88.4% (missing $n$ = 26) | 85.1% |
| % English Language Learners | 39.8% | 41.9% (missing $n$ = 3) | 36.4% |
| % Special Education | 5.5% | 6.1% | 2.8% |

Source: Early Childhood Data System (ECDS), 2014–15; Public Education Information Management System (PEIMS), 2014–15 and 2015–16; Observations of Texas public prekindergarten classrooms, May 2016

As mentioned, because the 2015–16 ECDS student-level data were not available at the beginning of this study due to the limited timeframe for the study, the site selection was based on the campus-level 2015–16 BOY kindergarten progress monitoring data. To verify the selection of these highly rated sites, the study team used the student-level 2015–16 BOY kindergarten school readiness indicators to calculate the school readiness rate for prekindergarten students enrolled in the observed sites during 2014–15 and compared it with the entire ECDS sample.[86] As Table 2.10 shows, the average school ready rate of students in the observed sites was 68%, significantly higher than the 58% of students in the ECDS sample (p<0.01); 72% of the observed campuses, but only 27% of all ECDS

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[85] See Appendix A for additional detail on the selection process for prekindergarten observations, and Appendix C, Table C.1 for a list of the observed districts and campuses.

[86] Student-level data allowing calculation of a school ready status were not available during site selection but were available in time to include this analysis in the report.

campuses, had BOY school readiness rates of 60% or higher. Together, these comparisons suggest that the selected campuses were higher performing as indicated by school readiness progress monitoring tools.

**Table 2.10: School Readiness Rate of Observed Sites as Compared to All Students in ECDS, Beginning of Year 2015–16**

| | Observed Sites (Beginning of Year 2015–16) | ECDS Sample (2015–16) |
|---|---|---|
| Number of campuses | 32 | 806 |
| Overall school ready rate in 2015–16 | 68.4% | 58.4% |
| Minimum | 21.2% | 1.0% |
| Maximum | 100.0% | 100.0% |
| Percentage of campuses with over 60% school ready rate* | 71.9% | 27.0% |

Source: Early Childhood Data System, 2014–15 & 2015–16.
*The average school ready rate in the State of Texas in 2015–16 was 58%. The 60% cut point served as a marker for achieving at or above the state average.

Table 2.11 displays the average size of observed classrooms based on ECDS data for the 2014–15 school year compared to class size estimates obtained while onsite observing instructional practices of prekindergarten teachers. That is, Table 2.11 compares data collected during the observations in May 2016 and averaged at the campus-level to the campuses' data reported in 2014–15 in ECDS as 2015–16 ECDS data were not yet available. On average, campus-level class size at the time of the observations (16.6 students) was slightly larger than the average campus-level class size reported in ECDS in 2014–15 (15.8), while the median class size was slightly larger for the ECDS sample than what was observed. These differences were small enough to suggest that class size on the observed dates was generally similar to what the campuses reported in ECDS, at least in 2014–15. Both minimum and maximum class sizes were also similar between the two groups. The average class size was well within the Texas guideline not to exceed a class size of 22. In fact, average class size was greater than 20 at only 3 of the 32 observed campuses at the time of the observations (9% of campuses).

**Table 2.11: Class Size of Observed Public Prekindergarten Sites (May 2016) Compared to Observed Site Sample (2014–15)**

| | Observed Sites (ECDS 2014–15) | Observed Sites (May 2016) |
|---|---|---|
| Average | 15.8 | 16.6 |
| Median | 17.0 | 16 |
| Minimum | 1.0 | 3 |
| Maximum | 26.0 | 29 |
| 5th Percentile | 1.0 | 7 |
| 25th Percentile | 12.0 | 13 |
| 75th Percentile | 20.8 | 21 |
| 95th Percentile | 25.0 | 26 |

Source: Early Childhood Data System, 2014–15; Observations of Texas prekindergarten classrooms, May 2016
Note: These are campus-level averages, rather than the average of the 97 classrooms.

## DATA COLLECTION

Each member of the study team who observed prekindergarten classrooms attended a two-day training in Austin and was certified as a reliable CLASS PreK observer before conducting observations. Reliability for the instrument means that it is expected that two researchers observing the same period of instruction will provide ratings within one point of each other on each of the 10 CLASS PreK dimensions. Following their observations of teacher-child interactions, CLASS PreK observers rated each dimension on the following seven-point scale:

- Scores of 1-2 were assigned to classrooms where the quality of teacher-child interactions was low. Classrooms in which there was substandard management of behavior, instruction that was rote in nature, or the lack of interaction between teachers and children received low scores.
- Scores of 3-5, the mid-range, were provided when classrooms showed a mix of effective teacher-student interactions with periods when interactions were not effective or were absent.
- Scores of 6-7 were assigned to classrooms where effective teacher-child interactions were consistently observed throughout the observation period.

While onsite, observers completed three 12-minute observation cycles in each of the 97 classrooms using the CLASS PreK to score each of the 10 dimensions based on observed behaviors on a number of key indicators (see Table 2.8).[87] To condense the three observations of each teacher into an average score for the classroom, the study team created a unique identifier for each lead teacher by combining the teacher's name, date of observation, and campus.[88] The average number of students, number of adults (i.e., teachers and/or educational aides), and dimension-level CLASS PreK scores were then calculated for each teacher in order to arrive at a single metric for each variable.[89] In addition, observers took detailed field notes that were used in the scoring of each segment observed. The field notes also served to document best or promising practices used by prekindergarten teachers across the state, in relation to each of the CLASS PreK dimensions.

## Observation Findings

This section presents findings from the prekindergarten classroom observations. The relationship between the two structural measures (class size and student-to-teacher ratio) and each of the CLASS PreK dimension scores, as well as the overall CLASS PreK domain level scores, were explored.

### CLASS SIZE AND STUDENT-TO-TEACHER RATIO

As Figure 2.2 illustrates, the average class size within the observed prekindergarten classrooms was approximately 17 (ranging from three to 29). Approximately 80% of the observed classrooms met the TEA recommendation to limit class size to 22 students. The average student-to-teacher ratio among observed classrooms was approximately 12 students per teacher (ranging from 2:1 to 27:1).[90] Most commonly, the prekindergarten classrooms observed included a lead teacher and an educational aide providing instruction and support to students. In 63% of the classrooms observed, there were two or more instructional staff (e.g., teachers or educational aides) in the classroom for at least one of the three observation cycles. In 52% of the classrooms observed, two or more teachers or educational aides were present for all three observation cycles.

Figure 2.3 presents the distribution of the students-to-teacher ratio in each of the 97 classrooms observed by study team members in May 2016. As Figure 2.3 shows, it was most common for observed classrooms to have student-to-teacher ratios in the 6:1 to 10:1 range. Eight or more observed classrooms were represented in each of the ratios in this range, accounting for 46% of the 97 classrooms observed. As compared to the state recommendation for the prekindergarten programs funded by the High-Quality Prekindergarten Grant program to maintain a student-to-teacher ratio of 11:1, 58% of the observed classrooms would have met or exceeded this expectation.

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[87] While observation cycles of 20 minutes are optimal, those of over 10 minutes in duration are valid as per CLASS guidelines. It was necessary to reduce the observation time slightly to fit in three observations cycles followed by eight minutes of CLASS coding. This allowed each classroom to receive three independent CLASS scores for each of the ten dimension to improve the reliability of CLASS scores.

[88] All three observation cycles occurred on the same day for each classroom.

[89] The number of students, number of adults (used in student-to-teacher ratio calculations) and the CLASS PreK dimension-level observations scores were averaged across the three periods observed for each classroom.

[90] Class size was calculated as the average number of students present across the three observation window. The student-to-teacher ratio was calculated by dividing the number of students in each classroom by the number of teachers or educational aides present in the classroom during the observation cycle.

**Figure 2.2: Average Class Size and Student-to-Teacher Ratio from Observed Classrooms, 2016**
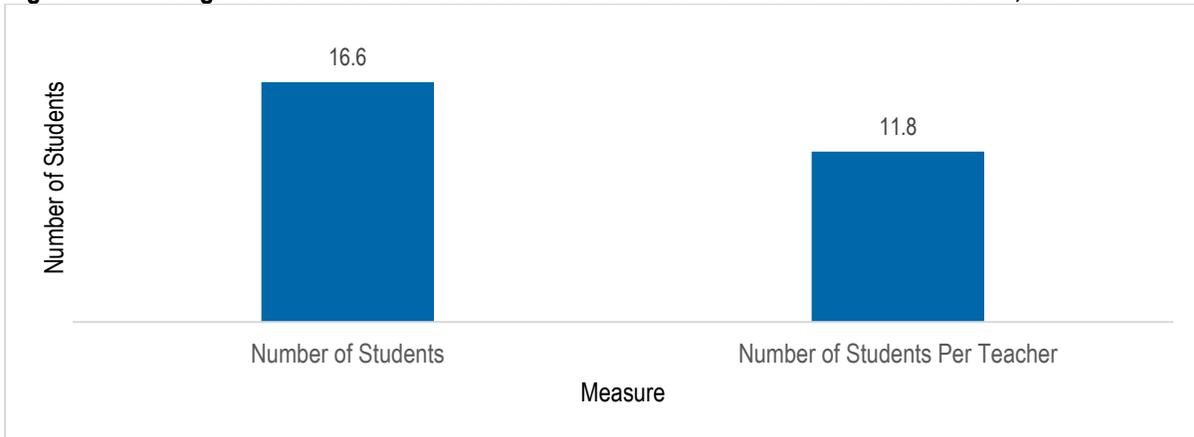


Source: Observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 observations.

**Figure 2.3: Distribution of Student-to-Teacher Ratios from Observed Classrooms, 2016**
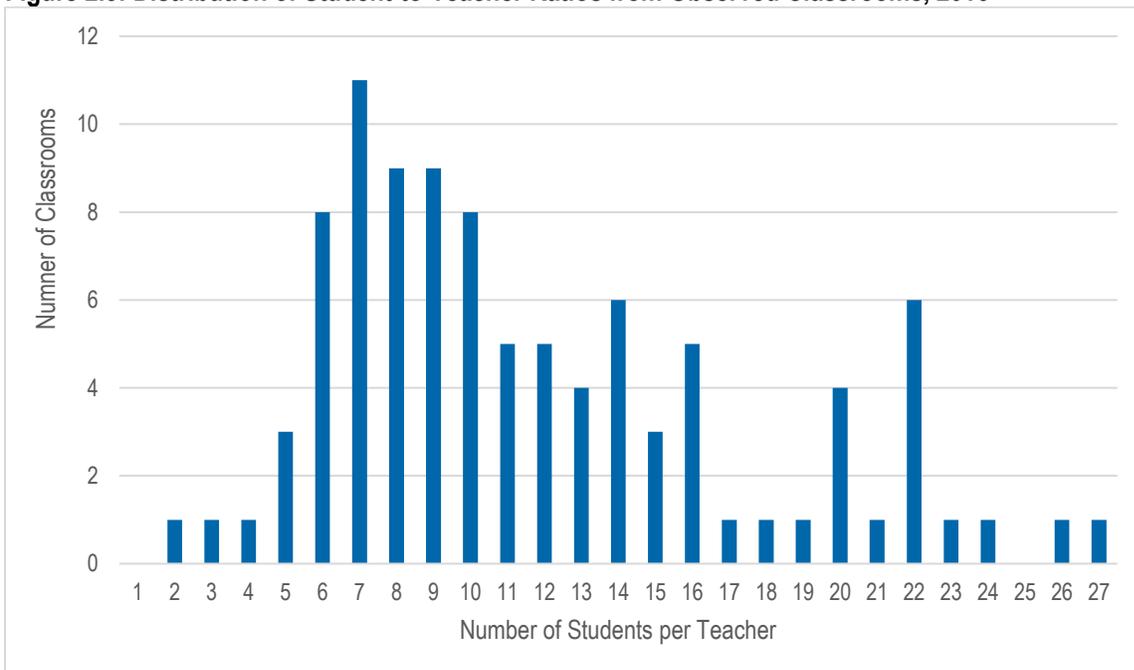


Source: Observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations.

## CLASS PreK DIMENSION AND DOMAIN SCORES

Prior to exploring the relationships between class size, student-to-teacher ratios, and CLASS PreK observation scores, it is important to understand the variance in scores by dimension and domain. Reporting of dimension- and domain-level CLASS PreK scores helps to unpack the scores in a way which helps to inform the discussion of how class size and student-to-teacher ratios may be related to teacher performance. It also helps to underscore the variation in prekindergarten teacher effectiveness (as measured by CLASS PreK) and the need for teacher professional development (PD) and highlight areas where targeted PD would be most beneficial. Domain scores were calculated by averaging the CLASS PreK dimension scores that make up each domain. The overall CLASS PreK score is the average of the 10 CLASS PreK dimension scores reported for each observed classroom.

As Figure 2.4 illustrates, observed prekindergarten classrooms scored highest on the Classroom Organization domain (average = 5.11), followed by Emotional Support (average = 4.86). Similar to data reported in other studies across the country, the Instructional Support domain was rated substantially lower (average = 2.36) (Pianta, La Paro, & Hamre, 2015).[91] The average overall CLASS PreK score across the 97 observed classrooms was 4.19, falling right in the midrange of the CLASS PreK rating scale and indicating moderate levels of quality in teacher-student interactions.

**Figure 2.4: Average CLASS PreK Domain Scores from Observed Classrooms, 2016**
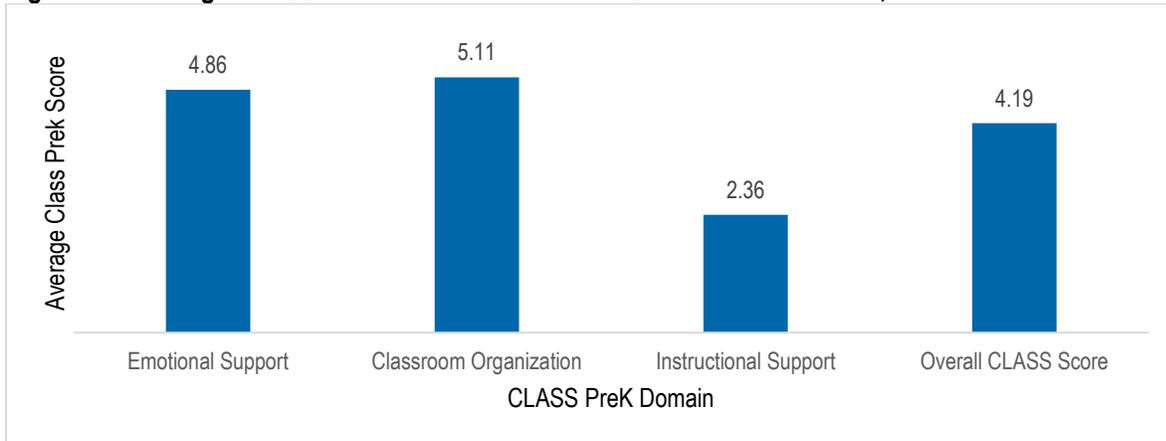


Source:     CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations.

The observed classrooms varied substantially across the dimensions of adult-child interactions measured by the CLASS PreK. As Table 2.12 shows, the classrooms generally received higher scores for dimensions in the Emotional Support and Classroom Organization domains (with the exception of the Regard for Student Perspectives dimension in Emotional Support). The highest rated dimensions included Negative Climate (reverse coded, meaning instances of negative climate were rarely observed) with an average score of 6.64 on the seven-point CLASS PreK scale, Behavioral Management (average = 5.42), Productivity (average = 5.21), and Positive Climate (average = 5.02).

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[91] Data from the NCEDL Multi-State Study of Prekindergarten demonstrate that the Instructional Support domain ranged from 2.04 to 2.17 across four cycles of observations. That study also showed that average Instructional Support domain scores ranged from 1.91 to 2.0 between fall and spring observations. Another study of prekindergarten classrooms, based on Center for Advanced Study of Teaching and Learning at the University of Virginia My TeacherPartner (MTP) data, found that Concept Development scores ranged from 2.16 to 2.88, and Quality of Feedback scores ranged from 1.71 to 2.06. While this is an indication of lower quality in this domain, the scores observed in the 97 Texas classrooms are not substantially different than those of other prekindergarten classrooms observed in other studies across the country.

**Table 2.12: Average CLASS PreK Domains and Dimensions from Observed Classrooms**

| Variable | Average CLASS PreK Score | Standard Deviation | Minimum CLASS PreK Score | Maximum CLASS PreK Score |
|---|---|---|---|---|
| **Emotional Support Domain** | **4.86** | **1.00** | **2.50** | **6.92** |
| Positive Climate Dimension | 5.02 | 1.43 | 2.00 | 7.00 |
| Negative Climate Dimension [a] | 6.64 | 0.57 | 4.00 | 7.00 |
| Teacher Sensitivity Dimension | 4.63 | 1.25 | 2.00 | 7.00 |
| Regard for Student Perspectives | 3.15 | 1.52 | 1.00 | 6.67 |
| **Classroom Organization Domain** | **5.11** | **0.97** | **2.56** | **7.00** |
| Behavioral Management Dimension | 5.42 | 1.05 | 2.00 | 7.00 |
| Productivity Dimension | 5.21 | 1.23 | 2.33 | 7.00 |
| Instructional Learning Formats Dimension | 4.69 | 1.11 | 2.33 | 7.00 |
| **Instructional Support Domain** | **2.36** | **0.97** | **1.11** | **5.67** |
| Concept Development Dimension | 2.04 | 0.90 | 1.00 | 5.33 |
| Quality of Feedback Dimension | 2.60 | 1.05 | 1.00 | 6.33 |
| Language Modeling Dimension | 2.45 | 1.18 | 1.00 | 6.00 |
| **Overall CLASS PreK Score** | **4.19** | **0.88** | **2.10** | **6.57** |

Source:  CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations. [a] The negative climate dimension score was reverse coded to be similar to other dimensions where a higher score reflects a more positive outcome.

The lowest rated dimensions were found in the Instructional Support domain (see Table 2.12). Instructional Support measures how teachers support and extend children's thinking, problem solving and conversational skills, and vocabulary. Effective teachers support children's engagement by making concepts and skills relevant to their lives outside of the school environment, asking open-ended questions that encourage children to analyze, reason, and predict outcomes.[92] This has historically been a difficult area for teachers to score on the high end of the seven-point range. Specifically, the average score for Concept Development, which measures the teacher's use of instructional discussions and activities to promote students' higher-order thinking skills and cognition (i.e., analysis and reasoning, creating, integrating concepts and prior knowledge, and making connections to the real world), was 2.04 on the seven-point CLASS PreK scale.[93]

Additionally, within the Instructional Support domain, the Quality of Feedback dimension, which measures the extent to which the teacher provided feedback to expand learning and understanding and to encourage student engagement (e.g., through open-ended questions and dialogue with students), received an average observation score of 2.60. The Language Modeling dimension, which captures the quality and quantity of teachers' use of language stimulation and language facilitation techniques (i.e., frequent conversation, open-ended questions, repetition and extension, self- and parallel-talk, and advanced language), received an average observation score of 2.45, as shown in Table 2.12. Average CLASS PreK scores in the low range of the seven-point scale indicate that efforts should be made to improve the quality of teacher-student interactions within each of the three dimensions (Concept Development, Quality of Feedback, and Language Modeling) included in the instructional support domain. Improvement in instructional practices could be accomplished through the availability of more systematic, high-quality PD for prekindergarten teachers in Texas. The relevance of this finding will become more clear when the relationship between student-to-teacher ratios and CLASS PreK scores for the Instructional Support Domain are explored later in this section.

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[92] For additional detail about interpreting CLASS PreK domains and dimensions, please refer to
   http://eclkc.ohs.acf.hhs.gov/hslc/hs/sr/class/use-of-class.pdf

[93] Concept Development and the other two Instructional Support dimensions (i.e., Quality of Feedback and Language Modeling), are consistently among the lowest rated CLASS dimensions with average ratings in the 2.0 to 3.0 range (Pianta, La Paro, & Hamre, 2015).

**RELATIONSHIP BETWEEN CLASS SIZE, STUDENT-TO-TEACHER RATIO, AND CLASS PREK SCORES**

To determine if there is a statistical relationship between class size in prekindergarten classes and the presence of more effective teacher-student interactions (as measured by CLASS PreK scores), or between student-to-teacher ratios in prekindergarten classes and CLASS PreK scores, the study team conducted a series of descriptive and correlation analyses.

The correlation analysis of the observation data revealed no evidence of a linear relationship between class size, student-to-teacher ratios, and overall CLASS PreK or domain-level observation scores. When class size or the student-to-teacher ratio in a prekindergarten classroom increase, CLASS PreK scores did not increase or decrease consistently (e.g., CLASS scores were not systematically related to class size or student-to-teacher ratio).

As Table 2.13 shows, there is a weak negative correlation between student-to-teacher ratio and the Emotional Support ($r=-.14$) and Instructional Support ($r=-.15$) domains, as well as the overall CLASS PreK observation score ($r=-.11$) assigned to each classroom but none of these were statistically significant. There is no statistical relationship between student-to-teacher ratios and CLASS PreK scores on the Classroom Organization domain ($r=.02$). Similarly, a weak negative relationship was found between class size (i.e., number of students present in the classroom during the observation) and CLASS PreK observation scores on the Emotional Support ($r=-.09$) and Instructional Support ($r=-.13$) domains. A very weak positive correlation was found between class size and CLASS PreK scores on the Classroom Organization ($r=.05$) domain. In summary, the correlations presented here indicate that when the class size increases, or the student-to-teacher ratio increases, CLASS PreK observation scores do not increase or decrease consistently.

**Table 2.13: Correlation Matrix Examining Relationship between Student-to-Teacher Ratios, Class Size, and CLASS PreK Domain-Level Scores from Observed Classrooms, 2016**

| Correlation Matrix | Student-to- Teacher Ratio | Class Size | Emotional Support | Classroom Organization | Instructional Support | Overall CLASS PreK Score |
|---|---|---|---|---|---|---|
| Student-to-Teacher Ratio | 1.0 | | | | | |
| Class Size | 0.68 | 1.0 | | | | |
| Emotional Support | -0.14 | -0.09 | 1.0 | | | |
| Classroom Organization | 0.02 | 0.05 | 0.74 | 1.0 | | |
| Instructional Support | -0.15 | -0.13 | 0.69 | 0.61 | 1.0 | |
| Overall CLASS PreK Score | -0.11 | -0.07 | 0.93 | 0.87 | 0.85 | 1.0 |

Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results based on 97 classroom observations.

To better understand the relationship between class size, student-to-teacher ratios, and CLASS PreK scores, the study team also created scatterplot charts which can be found in Appendix C. The scatterplots demonstrate visual evidence that there is a wide range of class scores for classrooms with the same student-to-teacher ratios which suggests that there is not a clear linear relationship between student-to-teacher ratio and any of the CLASS PreK domains. That is, as the student-to-teacher ratio increases, CLASS PreK scores do not systematically decline for any of the four scatterplots presented in Figure C.1 in Appendix C. These visualizations confirm the weak linear relationships between class size and student-to-teacher ratios, and CLASS PreK observation scores.

To further explore the relationship between student-to-teacher ratios and CLASS PreK scores, the study team organized the classrooms into quartiles according to student-to-teacher ratios. The lower the ratio, the fewer the number of students per teacher in the classroom. Table 2.14, which presents the average value for each of the three

CLASS PreK domains for each quartile of student-to-teacher ratios, shows that the highest CLASS PreK scores were observed in the third quartile (with student-to-teacher ratios ranging from 11:1 to 15:1), with only slightly lower CLASS PreK scores observed in the first quartile (with student-to-teacher ratios in the 2:1 to 7:1 range) and the second quartile (with student-to-teacher ratios in the 8:1 to 10:1 range). The lowest CLASS PreK scores were observed in the fourth quartile with the highest student-to-teacher ratios of 16:1 to 27:1. The lack of a clear pattern in the average CLASS scores in Table 2.14 suggests that there is not a consistent, linear relationship between class size and CLASS PreK observation scores (i.e., that CLASS PreK scores in quartiles with smaller student-to-teacher ratios would be higher than those in quartiles with progressively larger student-to-teacher ratios).

**Table 2.14: Average CLASS PreK Scores from Observed Classrooms by Student-to-Teacher Ratio Quartiles, 2016**

|  | First Quartile (2:1 to 7:1) | Second Quartile (8:1 to 10:1) | Third Quartile (11:1 to 15:1) | Fourth Quartile (16:1 to 27:1) |
|---|---|---|---|---|
| Average Class Size within Quartile | 10.9 | 17.1 | 17.1 | 21.3 |
| Emotional Support CLASS PreK Score | 4.90 | 4.87 | 5.21 | 4.43 |
| Classroom Organization CLASS PreK | 5.11 | 4.96 | 5.35 | 5.03 |
| Instructional Support CLASS PreK | 2.48 | 2.29 | 2.71 | 1.95 |
| Overall CLASS PreK Score | 4.24 | 4.12 | 4.50 | 3.87 |
| Number of Classrooms Observed | 25 | 25 | 24 | 23 |

Source:    CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations.

While data presented in Tables 2.13 and 2.14 strongly support the notion that there was generally not a linear relationship between prekindergarten student-to-teacher ratios and student-to-teacher interactions as measured by the CLASS PreK observation protocol, CLASS PreK scores for two of the three domains (Emotional Support and Instructional Support) were significantly lower ($p<.05$) for the 28% of classrooms with ratios of 15:1 or higher, when compared to classrooms with student-to-teacher ratios of less than 15:1 (Figure 2.5).

As Figure 2.5 illustrates, the average CLASS PreK score for Emotional Support was significantly lower for classrooms with student-to-teacher ratios in excess of 15:1 (average = 4.43) when compared to classrooms with ratios of 15:1 or lower (average = 4.99). Similarly, the average CLASS PreK score for the Instructional Support domain was significantly lower for classrooms with student-to-teacher ratios greater than 15:1 (average = 1.95) when compared to classrooms with ratios of 15:1 or less (average = 2.49).[94] Statistically significant differences were not found for the Classroom Organization domain. Finally, classrooms with a student-to-teacher ratio above 15:1 were found to have significantly lower overall CLASS PreK scores than those with ratios of 15:1 or less ($p<.05$). However, due to the small sample size, particularly in the greater than 15:1 category (*n* = 23; 24% of observed samples), this finding should be viewed with caution and warrants further research. These results suggest that directors of prekindergarten programs should be mindful of student-to-teacher ratios and should be cautious about allowing ratios to go above 15 students per teacher because the quality of teacher-student interaction scores tends to decline around that level.

To test the sensitivity of the 15:1 threshold finding, the study team compared average CLASS PreK domain-level scores for classrooms with student-to-teacher ratios of 10:1, 11:1, 12:1, 13:1, 14:1, and 15:1 to classrooms with ratios below those thresholds. From this analysis, the only statistically significant differences observed were between classrooms with more than 15 students per teacher and those with ratios of 15:1 or lower.

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[94] T-tests were used to assess statistical significance. Differences for the Emotional Support and Instructional Support domains were significant at the .05 level.

**Figure 2.5: Average CLASS PreK Scores for Observed Classrooms by Student-to-Teacher Ratio, 2016**
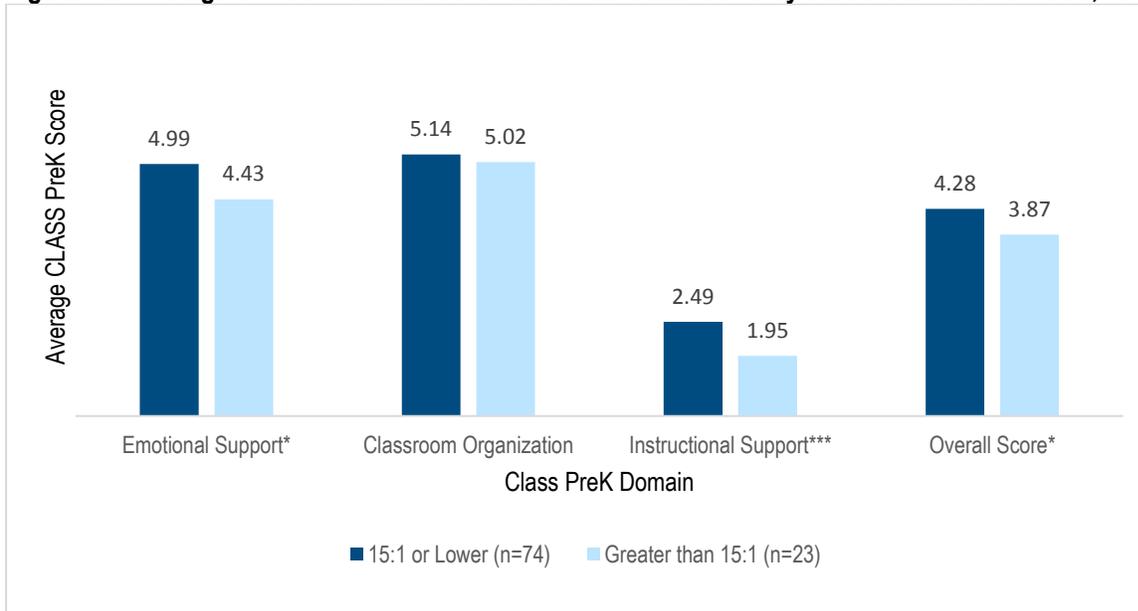


Source:    CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
* p<0.05, ** p<0.01, *** p<0.001.

Next, the study team organized the classrooms into quartiles according to class size. Similar to the student-to-teacher ratio analysis, Table 2.15 shows that there is not a consistent linear relationship between class size and CLASS PreK observation scores for any of the domains or overall. With a few exceptions, scores tend to dip slightly between the first and second quartiles of class size, rise between the second and third quartiles, then drop again between the third and fourth quartiles of class size. Some of this variation may be related to a second teacher or educational aide being added to classrooms in the third quartile causing a drop in student-to-teacher ratios and a rise in CLASS PreK observation scores.[95] At the same time, the lowest scores in two of the three domains (Emotional Support and Instructional Support) were again associated with class size in the highest quartile (i.e., 22-29).

**Table 2.15: Average CLASS PreK Scores from Observed Classrooms by Class Size Quartiles, 2016**

|  | First Quartile (3 to 13) | Second Quartile (14 to 16) | Third Quartile (17 to 21) | Fourth Quartile (22 to 29) |
|---|---|---|---|---|
| Emotional Support CLASS PreK Score | 4.99 | 4.75 | 5.00 | 4.66 |
| Classroom Organization CLASS PreK | 5.13 | 4.78 | 5.22 | 5.33 |
| Instructional Support CLASS PreK | 2.52 | 2.37 | 2.34 | 2.18 |
| Overall CLASS PreK Score | 4.29 | 4.04 | 4.27 | 4.12 |
| Number of Classrooms Observed | 27 | 24 | 24 | 22 |

Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations.

In summary, while there is not a clear linear relationship between class size or student-to-teacher ratios and the quality of teacher-student interactions as measured by CLASS PreK scores, there was evidence that when ratios were greater than 15:1, significantly lower CLASS PreK scores were observed on the Emotional Support and Instructional Support domains. This finding suggests that the quality of teacher-student interactions may be negatively impacted when student-to-teacher ratios exceed 15:1.

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[95] No statistically significant different differences between any of the CLASS PreK scores by class size were observed.

## EXAMINATION OF PROMISING OR BEST PRACTICES AMONG OBSERVED PREKINDERGARTEN CLASSROOMS IN TEXAS

This section examines promising practices observed in prekindergarten classrooms with CLASS PreK scores among the highest recorded in the 97 observed classrooms. Appendix D includes four vignettes exemplifying quality instructional practices based on CLASS PreK scores and field notes. As part of the CLASS PreK observation scoring process, observers relied on detailed indicators to score each of the ten dimensions. For example, for the Positive Climate dimension, evaluators rated the presence of positive affect, positive communications, relationships, and respect during each of the periods of observation. This same process was used for the other nine CLASS PreK dimensions.

As part of the CLASS PreK observation scoring process, the study team made note of instructional practices observed within individual classrooms. This section describes the makeup of classrooms which scored high on the CLASS PreK dimensions and domains in terms of class size and student-to-teacher ratios. Further, observer notes were used to document best or promising prekindergarten instructional practices observed across the sample.[96] To classify these notes into useful categories of promising prekindergarten instructional practices observed in Texas schools, the study team coded the notes using the CLASS PreK indicators.[97]

## DESCRIPTION OF CLASSROOMS WITH HIGH CLASS PreK INSTRUCTIONAL SUPPORT, CLASSROOM ORGANIZATION, AND INSTRUCTIONAL SUPPORT DOMAIN SCORES

Before describing promising practices observed in classrooms with the highest observed CLASS PreK scores, it is important to first establish how these classrooms may differ from the sample of classrooms observed in terms of student-to-teacher ratios and class size. As Figure 2.6 shows, classrooms rated highest (i.e., the top 10) on the three CLASS PreK domains had lower average student-to-teacher ratios than the average of all 97 classrooms observed.[98] The lowest average ratio was observed in classrooms which recorded the highest scores on the Instructional Support domain (average = 8:1) compared to the average of 12:1 across all observed classrooms.[99] The Instructional Support domain includes the developmentally critical Concept Development, Quality of Feedback, and Language Modeling dimensions. The study team looked further into this relationship by disaggregating the findings by the three Instructional Support dimensions and similar results were observed. The highest rated classrooms on the Concept Development (average = 9:1), Quality of Feedback (average = 9:1), and Language Modeling (average = 8:1) all had lower average ratios than the overall average of 12:1. The average student-to teacher ratios observed in classrooms which recorded the highest observation scores on the Emotional Support (average = 10:1) and Classroom Organization domains (average = 11:1) were also slightly lower than the overall average (Figure 2.6).

The findings for the highest rated classrooms support the notion that the best teaching practices, as evidenced by CLASS PreK scores, occur more frequently in classrooms with lower student-to-teacher ratios. The most profound finding was that the Instructional Support domain, which assesses the ways in which teachers implement the curriculum to effectively promote cognitive language development, was rated highest in classrooms with lower student-to-teacher ratios. A summary of observer notes for classrooms with the highest CLASS PreK Instructional Support domain scores (which also had lower than average student-to-teacher ratios) are presented in this section to illustrate the types of instructional practices and teacher-student interactions that are indicative of best practices in classrooms across the state of Texas.

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[96] Promising practices are reported for classrooms which scored in the high range (6-7) for dimensions in the Emotional Support and Classroom Organization domains, and in the mid-range (3-5) for the dimensions included in the Instructional Support domain on the CLASS PreK protocol.

[97] The negative climate dimension was not included in the best practices analysis because promising or best practices in prekindergarten instruction are not captured in this dimension. Only negative behaviors by teachers weigh into the negative climate dimension score.

[98] Classroom Organization includes 11 classrooms because two with the 10th highest score recorded identical CLASS scores for that domain.

[99] The range of student-to-teacher ratios for this group of classrooms with the highest Instructional Support domain scores is 2:1 to 14:1.

**Figure 2.6: Average Student-to-Teacher Ratio in Observed Classrooms (Classrooms with Highest Emotional Support, Classroom Organization, and Instruction Support Domain Scores Compared to All Observed Classrooms), 2016**
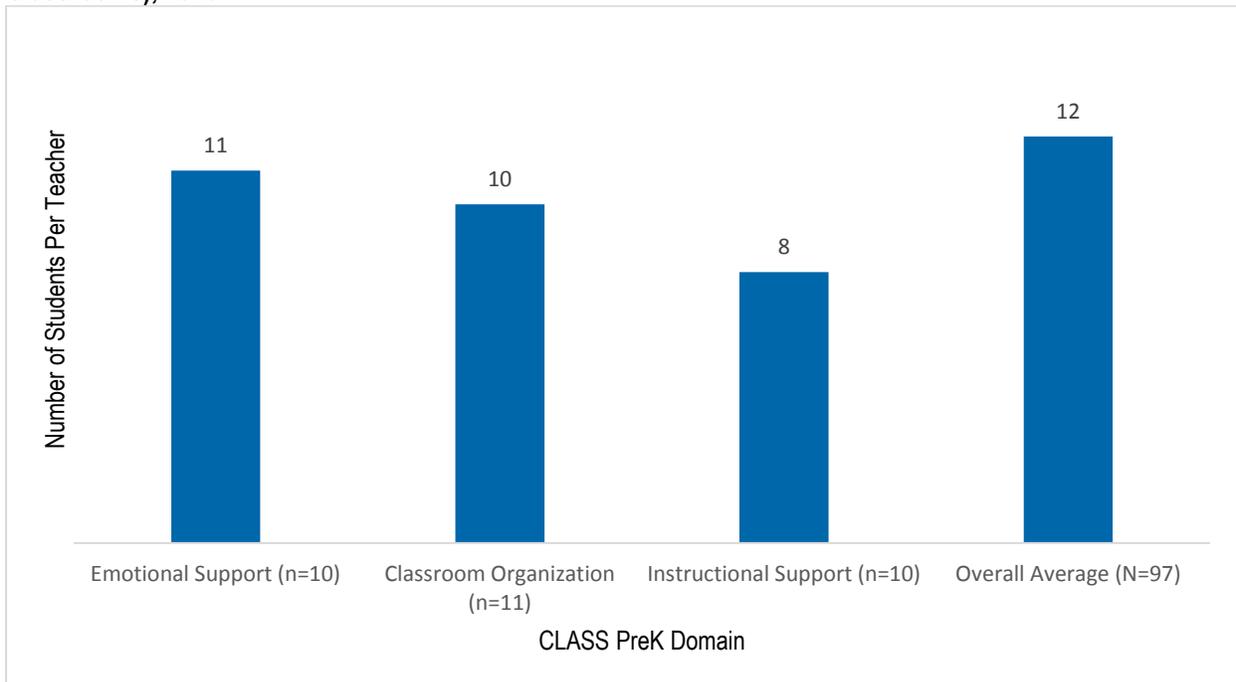


Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016

In contrast to the findings presented in Figure 2.6 related to student-to-teacher ratios in classrooms with the highest CLASS PreK domain-level scores, results were mixed when class size was examined, as shown in Figure 2.7. Classrooms rated highest on the Instructional Support (13.4 students) and Classroom Organization (15.2 students) had fewer students than the overall average class size across of all 97 classrooms observed (16.6 students). However, classrooms rated highest on the Emotional Support domain had a slightly higher average student count (17.7 students) than the overall average of 16.6. It is important to note that the largest variance was observed for the Instructional Support domain, with the highest rated classrooms on Instructional Support having an average of 3.2 fewer students than the average class size across the entire sample of observed classrooms. Again, these findings for the highest rated classrooms support the notion that the best teaching practices may occur more frequently in classrooms with smaller class sizes.

**Figure 2.7: Average Class Size in Observed Classrooms (Classrooms with Highest Emotional Support, Classroom Organization, and Instruction Support Domain Scores Compared to All Observed Classrooms), 2016**
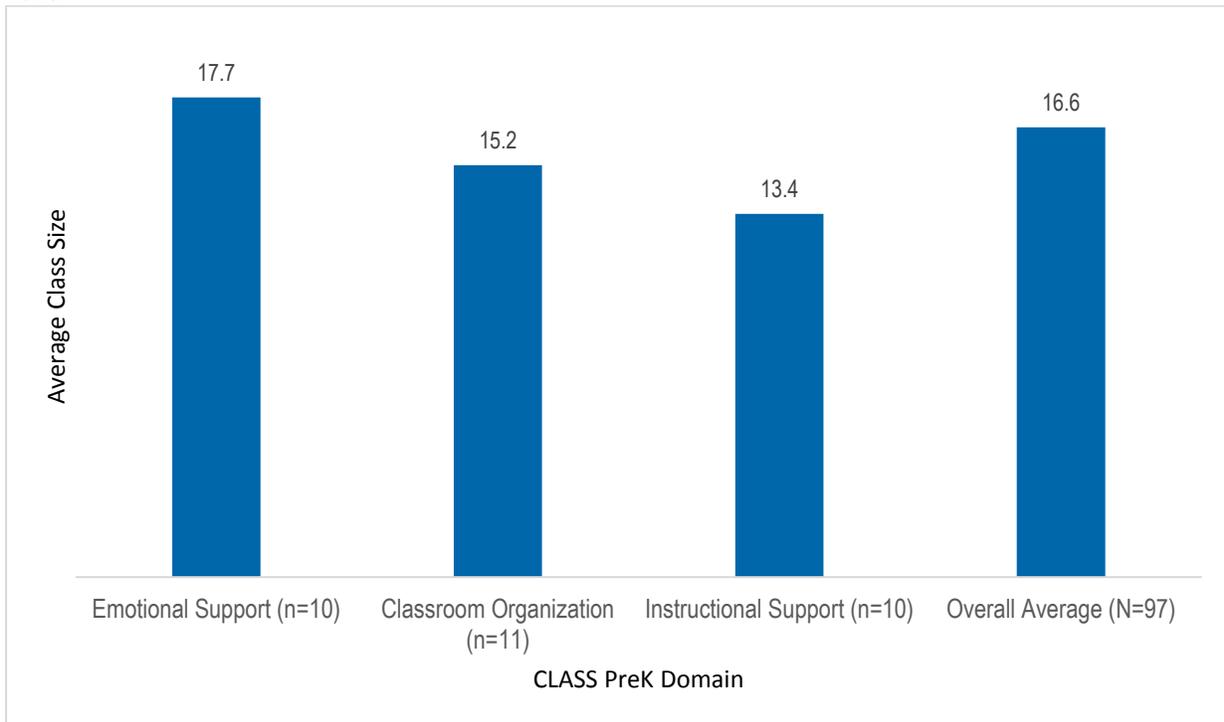


Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016

While the number of classrooms included in the "highly rated" groups is small (n=10 to 11 classrooms) and this information should be interpreted with caution, Figures 2.6 and 2.7 suggest that classrooms with the highest rated teacher-student interactions on the critical Instructional Support domain had smaller class sizes and smaller student-to-teacher ratios that the population of classrooms observed in the spring of 2016. A similar, though less robust finding was observed for the Classroom Organization domain, while mixed results were shown for the Emotional Support domain. The remainder of this section highlights promising practices observed in exemplar classrooms with the highest observation scores on the Instructional Support domain, given the consistent relationships found between the highest rated classrooms in the Instructional Support domain and student-to-teacher ratios. Promising practices for CLASS PreK dimensions contained in the Emotional Support and Classroom Organization domains are presented in Appendix E.

**Best Practices Observed for Concept Development Dimension (Instructional Support Domain).** Among the teachers who scored the highest (i.e., top 10% for Concept Development), all four indicators of this dimension were observed: Analysis and Reasoning, Creating, Integration, and Connections to the Real World. Examples of promising practices aligned with each indicator are presented in Table 2.16.

**Table 2.16: Promising Practice Examples for the Concept Development Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Analysis and Reasoning** encompasses why/how questions, problem solving, prediction/experimentation, classification/comparison, and evaluation. | *"The teacher asked inquiry-based predictive questions of students about what was happening in the book, what students thought was going to happen and why. The teacher used classification and sorting techniques in some of the small table activities (e.g., sorting bills into 1's, 5's, 10's, and discarding 20's and 50's, then counting the money using techniques previously learned, which he referenced on the board (e.g., tally, counting by 5's and 10's)."*<br><br>*"Teacher and children brainstormed what would happen if they did not put a roof on the house. Teacher asked questions to help children critically think, such as 'Do you think we should use a hammer? What else can we build?'"* |
| **Creating** refers to brainstorming, planning, and producing. | *"The children were allowed to be creative by choosing what they would like to build."* |
| **Integration** is defined as connecting concepts and integrating lessons/activities with previous knowledge. | *"Children were learning about community helpers, construction workers. The theme was integrated throughout the classroom with books, dramatic play props, and waffle blocks used to construct buildings."*<br><br>*"The teacher also tried to integrate today's lesson into what they learned yesterday about money."* |
| **Connections to the Real World** are marked by real-world applications and activities/lessons related to students' lives. | *"The teacher attempted to connect money to the real world with questions like 'How can you earn money,' asking about the value of different services and how students can ask parents about jobs they can do around the house to earn money. She asked what types of things they would like to buy with money."*<br><br>*"The teacher used a construction theme and talked about the construction going on around the school to explain what construction workers do… The teacher [also] made a comment about one child's block design, "It looks like the Pentagon Building, in Washington, D.C.?" She got a book with a picture of the Pentagon to show the child."* |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas public prekindergarten classrooms, May 2016

**Best Practices Observed for Quality of Feedback Dimension (Instructional Support Domain).** Among the teachers who scored the highest for Quality of Feedback (i.e., top 10%), all five indicators of this dimension were observed. Prompting Thought Processes was observed less frequently than Encouragement and Affirmation, Feedback Loops, Providing Information, and Scaffolding. Table 2.17 provides examples of promising practice associated with each indicator for this dimension.

**Table 2.17: Promising Practice Examples for the Quality of Feedback Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Scaffolding** refers to the teacher giving students context clues and structured assistance in a variety of ways. | *"The teacher and aide provided often/consistent scaffolding (e.g., helping children think of what plants need to grow) and assistance (e.g., while working on a puzzle or working on a pattern, the aide said: 'What comes after one?' 'Let's go look for it over there')."*<br><br>*"The teacher was masterful at scaffolding with students from simply helping to sound out letter sounds and words, to more sophisticated scaffolding like using sky, grass, and the middle to refer to where top and bottom of letters should be when writing then on a line. She referring to certain letters as special which go 'under the dirt' such as lower case 'p.'"* |
| **Feedback Loops** are back-and-forth exchanges with persistence by the teacher and/or follow-up questions. | *"The teacher engaged students in multiple feedback loops about why numbers are larger or smaller."*<br><br>*"There were several feedback loops heard between teacher and children on their activities around construction. The teacher used effective questioning, such as 'Are you big or small?' 'What do you think we can use?' Several feedback loops were heard about the pattern of the blocks."*<br><br>*"There were some follow-up questions observed (e.g., 'What else does a plant need to grow?')."* |
| **Prompting Thought Processes** is defined as asking students to explain their thinking and/or querying their responses and actions. | *"The teacher asked questions about how [the children] were using the tools and why they chose that tool."* |
| **Providing Information** means expanding on students' understanding or actions, and/or providing clarification or specific feedback | *"The teacher explained to children why you cannot use a saw on a brick house… [and] why she needed safety glasses."*<br><br>*"The teacher provided additional information to students after hearing responses."* |
| **Encouragement and Affirmation** encompass recognition and/or reinforcement that increases student involvement/persistence. | *"The teacher and educational aide regularly encouraged students (e.g., 'I like your patterns; that is a very good idea!') Students were regularly encouraged to persist in answering a question or writing at the board."*<br><br>*"Recognition/affirmation from the teacher that encouraged participation: 'I love how you're blending your letters to make a word—kiss your brain, good job!'"* |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas public prekindergarten classrooms, May 2016

**Best Practices Observed for Language Modeling Dimension (Instructional Support Domain).** Among the teachers who scored the highest (i.e., top 10% for Language Modeling), all five indicators of this dimension were observed. The Self- and Parallel-Talk indicator was observed less frequently than Frequent Conversation (coded in all nine observations), Advanced Language, Open-Ended Questions, and Repetition and Extension. Table 2.18 provides examples of promising practice associated with each indicator for this dimension.

**Table 2.18: Promising Practice Examples for the Language Modeling Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Frequent Conversation** encompasses back-and-forth exchanges, contingent responding, and/or peer conversations. | *"Frequent conversations were observed in the classroom, more peer-to-peer than teacher/aide with child conversations. A few examples of back-and-forths between the teacher and children (e.g. a child talking about wanting a driver's license, the teacher asking a child about sunflowers)."*<br><br>*"During center time, conversations among students were commonly observed. (e.g., Student 1: 'Those are my tools' Student 2: 'I'm a man' Student 1: 'I'm a man too' Student 2: 'Let's work together' Student 2: 'We are going to build a house')."* |
| **Open-Ended Questions** are defined as questions that students respond to that require more than a one- or two-word response. | *"The teacher used a mix of closed/open-ended questions, but consistently initiated child responses."*<br><br>*"The teacher used open-ended questions (e.g., 'What colors do you see in the Mexican blanket?' 'What is money?' 'What is something you use money for?')."* |
| **Repetition and Extension** means that the teacher repeats and/or extends students' responses. | *"The teacher was consistent in repeating and extending student responses."* |
| **Self- and Parallel-Talk** are defined as the teacher mapping his/her own actions or student actions with language. | *"The teacher effectively used self-talk when showing [the children] how to use a saw."* |
| **Advanced Language** refers to the teacher's use of a variety of words and/or connecting words to familiar words/ideas. | *"Advanced language was also introduced (e.g., Teacher: 'I am going to model this activity for you. Do you know what model means?' Student: 'To show us how')."* |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas public prekindergarten classrooms, May 2016

## Observation Study Conclusions

For the third study component, 97 classrooms at 32 campuses in 16 districts were selected based on their potential to exhibit high-quality instructional practices. The average class size within the observed prekindergarten classrooms was approximately 17 students (ranging from three to 29), and the average student-to-teacher ratio among observed classrooms was approximately 12 students per teacher (ranging from 2:1 to 27:1). In two-thirds of classrooms (63%), there were two or more instructional staff (e.g., teachers or educational aides) in the classroom for at least one of the three (12 minute) observation cycles while the remaining classrooms were observed with only one teacher in all observation cycles.

Based on the analysis of CLASS PreK quality scores for these prekindergarten classrooms, there was little evidence of a linear relationship between class size or student-to-teacher ratios and class CLASS PreK scores on the Emotional Support, Classroom Organization, and Instructional Support domains and their related dimensions. That is, as class size or student-to-teacher ratios increased, there was not a corresponding clear change (increase or decrease) in the quality of teacher-student interactions as measured by CLASS PreK scores. However, classrooms with ratios higher than 15:1 had significantly lower overall CLASS PreK scores, as well as lower Emotional Support and Instructional Support domain scores, which suggests that quality interactions like those observed using the CLASS PreK were less likely to occur in classrooms exceeding 15:1 student-to-teacher ratios. While classrooms were selected to be high-quality, approximately 27% had student-to-teacher ratios that were associated with lower quality scores. This finding merits further research with a larger observation sample.

The research presented in this section also sheds light on examples of effective teaching practices classrooms with the highest CLASS PreK observation scores. Classrooms with the highest Instructional Support domain scores had lower average student-to-teacher ratios (8:1) and lower class sizes (13) than the population of all observed classrooms (12:1 and 17, respectively). This also held for classrooms with the highest Concept Development, Quality of Feedback, and Language Modeling CLASS PreK dimension scores. In these highly rated classrooms, high-performing teachers consistently engaged students in meaningful discussions though the use of open-ended questions, inquiry-based (e.g., how and why) questions, repetition and extension of student responses, the use of advanced language, and other techniques to challenge students to think deeper about the content being covered.

## Key Findings across Study Components

Through this study, the study team conducted research using three components: a literature search and review, analysis of available data on Texas public prekindergarten programs, and observations in high-performing prekindergarten classrooms throughout Texas to provide recommendations regarding the optimal class sizes and student-to-teacher ratios for prekindergarten classes in Texas. This section summarizes key findings from each of the study components individually, followed by findings across the analyses, first for class size and then for student-to-teacher ratios. These findings are aligned with study recommendations in Chapter 3.

### Literature Review Study Component Key Findings

Research indicates that it takes a combination of structural (e.g., class size, student-to-teacher ratio, teacher qualifications, teacher and staff compensation) and process (e.g., teacher-student interactions, type of instruction) components to create a high-quality out-of-home prekindergarten program and ensure an environment that provides the stimulation children need to learn. Structural features create classroom conditions in which teachers provided more meaningful and individualized instruction. Simply lowering student-to-teacher ratio and class size, which are the focus on of this study, without addressing other components, would not be sufficient to enhance child outcomes and increase school readiness among prekindergarten children. One challenge in studying these variables may be that many prekindergarten classrooms fall within a limited range of class sizes and student-to-teacher ratios (see the sections on the extant data and observation components for evidence of this in Texas).

Professional guidelines (e.g., NAEYC, NIEER) and National Head Start requirements are in agreement that class size not exceed 20 and that student-to-teacher ratio not exceed 10:1 with prekindergarten children. Most of the program guidelines in comparison states set optimal student-to-teacher ratios at 10:1 or lower and optimal maximum class sizes at 20 student or lower for 4- and 5-year-olds. In the literature review of states identified as moving toward high-quality prekindergarten practices statewide, none of the states had a class size over 22 students or a student-to-teacher ratio over 11:1, although the unique contributions of these two components of quality were not isolated in the research studies (e.g., Bartik, 2014; Wechsler, 2016). In fact, when the focus was on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students and student-to-teacher ratios between 8:1 (15:2) and 11:1 (22:2).[100] Teachers generally report that smaller class sizes are desirable and contribute to job satisfaction (Francis, 2014).

Texas Rising Star, the Texas QRIS, provides guidelines that assigns the highest ratings for classrooms of 4-year-old children that do not exceed 20 students in size and for classrooms of 5-year-old children that do not exceed 25 students in size. The DFPS minimum standards for Texas early childhood education programs also vary by age group and allow for a maximum group (class) size of 35 and a maximum student-to-teacher ratio of 22:1. TEA recommends that prekindergarten programs not exceed class sizes of 22 and that prekindergarten programs funded under Texas's new High-Quality Prekindergarten Grant program should attempt to maintain an average 11:1 student-to-teacher ratio.[101] The *State of Preschool 2015* reported that across the nation, 86% of all states met the quality

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[100] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

[101] TEA guidance is that all prekindergarten classrooms not exceed the statutory requirement set for kindergarten through Grade 4 of 22 students to 1 teacher. We have interpreted that here as a class size of 22.

standard for class sizes of 20 children or fewer and 88% met the quality standard of 10 children for 1 adult per classroom. Other states reported class sizes between 18 and 20 and student-to-teacher ratios between 8:1 and 10:1 (Barnett et al., 2016).

## Extant Data Analysis Study Component Key Findings

In 2014–15, the average class size of public prekindergarten programs in Texas was around 17 students, based on available data in ECDS. The majority of the Texas public prekindergarten classrooms in 2014–15 (72%) had class sizes at or below the class size of 20 (i.e., the quality standard used by NIEER for reviewing states' public prekindergarten programs) with an additional 15% having class sizes of 21 to 22 students. Only 11% of Texas public prekindergarten classrooms had a class size between 23 and 30 students and only 2% had class sizes greater than 30 students. This suggests that many Texas public prekindergarten programs are within the national standards, at least for maximum class size. Further research is needed to explore why some prekindergarten programs have such a large class size and how many teachers are associated with the larger classes.

Prekindergarten programs that entered data in ECDS were not instructed to provide data on teacher aides in the classroom, resulting in a sample for this study that had limitations. Thus, student-to-teacher ratios for the classrooms could not be calculated. In addition, reporting data into ECDS by prekindergarten programs is voluntary, with only 18% of districts participating. Comparisons to PEIMS data for Texas public schools in the 2014–15 school year suggests those reporting in ECDS were representative of the regions of the state and generally similar with regard to student demographics, although the ECDS sample was slightly older on average and had higher percentages of students identified as Hispanic.

## Classroom Observation Study Component Key Findings

For this study component, prekindergarten classroom observation data from 97 classrooms at 32 campuses from 16 districts across the state were analyzed (sites were selected for observation based on campus level BOY kindergarten progress monitoring scores and geographic region). Almost all (84%) of the observed classrooms had a class size of 22 or fewer students. In 63% of the classrooms observed, there were two or more instructional staff (e.g., teachers or educational aides) in the classroom for at least one of the three (12-minute) observation cycles and in 52% of the classrooms observed, two or more teachers or educational aides were present for all three observation cycles. Although the student-to-teacher ratio of 11:1 is recommended for the High-Quality Prekindergarten Grant program, it is worth noting that only 58% of the observed classrooms would have met this recommended student-to-teacher ratio if it were applied more broadly. Twenty-five percent of the observed classrooms had a student-to-teacher ratio of 16:1 or higher.

The analyses revealed no evidence that class sizes of the observed classrooms were related to CLASS PreK scores. This may be due in part to the limited range of class sizes in these settings. There was also no evidence of a linear relationship between student-to-teacher ratios and CLASS PreK scores. That is, when class size or student-to-teacher ratios increased, there was not a corresponding decline (or increase) in the quality of teacher-student interactions.

However, when student-to-teacher ratios were categorized as being at 15:1 and below or above 15:1, statistically significant differences in the average CLASS PreK scores for the Emotional Support and the Instruction Support domains were observed. That is, classrooms with student-to-teacher ratios of above 15:1 had significantly lower overall CLASS PreK scores, as well as Emotional Support and Instructional Support domain scores than classrooms with ratios of 15:1 or less, which suggests that quality interactions may be less likely to occur in the classrooms with the ratios greater than 15:1.

In classrooms with the highest CLASS PreK scores, student-to-teacher ratios were 15:1 and below in all cases. Several best practices were observed within these highest scoring classrooms, including more analysis and

reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, repetition and extension.

## Key Findings across Study Components

### CLASS SIZE

None of the early childhood education programs in the literature review that were associated with positive outcomes for children had a class size over 22. In fact, when the research focused on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students. Similarly, guidelines from national organizations on maximum class size are between 20 and 22 for four-year-olds (increasing to 20-24 for five-year-olds). The DFPS minimum standards for Texas early childhood education programs also varies by age group and allows for a maximum of 35 students for class size. TEA currently recommends that prekindergarten programs not exceed class sizes of 22, a requirement for kindergarten through Grade 4. The *State of Preschool 2015* reported that across the nation, 86% of all states met the quality standard for class sizes of 20 children or fewer (Barnett et al., 2016). National reviews examining progress in specific states focused on high-quality prekindergarten education also consistently find guidelines that class size not exceed 20 students (e.g., Wechsler, 2016).

The current guidance for Texas school districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program to maintain an average class sizes of 22 (i.e., not less than one certified teacher or teacher's aide for every 11 students) is therefore supported by the literature reviewed. The extant data analysis indicates that the average class size of public prekindergarten programs in Texas was around 17 students. This implies that many classrooms are already maintaining optimal class sizes that research demonstrates is associated with high quality.

### STUDENT-TO-TEACHER RATIO

The literature review indicates that early childhood education classrooms associated with positive outcomes for children did not exceed a student-to-teacher ratio over 11:1. When the research focused on components of high-quality prekindergarten and other early childhood education programs, the student-to-teacher ratios were between 8:1 (15:2) and 11:1 (22:2).[102] The national guidelines for student-to-teacher ratios vary by age group (3 and 4 to 5 years of age) and are between 7:1 and 12:1 for student-to-teacher ratios. The minimum standards for Texas child care also vary by age group and are between 15:1 and 22:1 for student-to-teacher ratio, including Texas's new High-Quality Prekindergarten Grant program, which recommends prekindergarten programs attempt to maintain an average student-to-teacher ratio of not less than one certified teacher or teacher's aide for every 11 students in their classrooms. The *State of Preschool 2015* reported that across the nation, 86% of all states met the quality standard of 10 children for 1 adult per classroom (Barnett et al., 2016). Other states reported student-to-teacher ratios between 8:1 and 10:1.

Based on the analysis of prekindergarten classroom observation data from 97 classrooms across the state, there was little evidence of a linear relationship between student-to-teacher ratios and CLASS PreK scores for Emotional Support, Classroom Organization, and Instructional Support domains (and their related dimensions). That is, when student-to-teacher ratios increased, there was not a corresponding decline in the quality of teacher-student interactions. However, when student-to-teacher ratios were separated by a threshold of 15:1, statistically significant differences in the average CLASS PreK scores for the Emotional Support and the Instruction Support domains were observed. Classrooms with student-to-teacher ratios of greater than 15:1 had significantly lower overall CLASS PreK scores, as well as Emotional Support and Instructional Support domain scores, than classrooms with ratios of 15:1 or less, which suggests that quality interactions may be less likely to occur in the classrooms with the ratios greater than 15:1. In classrooms with student-to-teacher ratios of 15:1 and lower, several best practices were observed including

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[102] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

more analysis and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of  information, scaffolding, advanced language use, open-ended questions, repetition and extension.

Although the student-to-teacher ratio (15:1 or less) from the classroom observation data is higher than the ratio suggested by research (no more than 11:1), both are associated with high-quality and positive child outcomes. The range of 11:1 to 15:1 student-to-teacher ratios provides Texas public prekindergarten classrooms the opportunity for progressing towards lower student-to-teacher ratios.

# Chapter 3: Recommendations for Future Policy Action about Class Sizes and Student-to-Teacher Ratios for Prekindergarten Classrooms in Texas

This chapter summarizes background information for the study, including the study purpose, which originated from HB 4 and study components; study limitations; and the recommendations regarding optimal class size and student-to-teacher ratios for Texas public prekindergarten programs.

## Background for the Study

In Governor Abbott's 2015 State of the State Address, he set improving early education, specifically improving public prekindergarten, as the first of his five emergency items (State of Texas Office of Governor, 2016).[103] The 84th Texas Legislature then passed House Bill (HB) 4, which Governor Abbott signed into law in May 2015. HB 4 places renewed emphasis on high-quality prekindergarten programming through:

- Authorization for a new prekindergarten grant program providing additional funding to schools that meet "quality standards related to curriculum, teacher qualifications, academic performance, and family engagement".[104]
- Expansion of early childhood education reporting requirements for all Texas public schools offering prekindergarten programs beginning in the 2016–17 school year.

HB 4 also added Texas Education Code (TEC) § 29.1545 (2015), which requires that the Texas Education Agency (TEA) conduct a joint study with the DFPS to develop recommendations regarding optimal class sizes and student-to-teacher ratios for prekindergarten classes.[105] At the time of this report, rules or laws specifying prekindergarten class sizes and student-to-teacher ratios in Texas have not yet been established;[106] however, the following guidance exists:

- TEA encourages local education agencies (LEAs) to maintain and not exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms (TEC § 25.112, 2015).[107]
- School districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program "…must attempt to maintain an average ratio in any prekindergarten program class of not less than one certified teacher or teacher's aide for every 11 students," per the addition of TEC § 29.167(d) (2015) by HB 4.[108]

According to TEC § 29.1545 (2015), the study recommendations regarding optimal class size and student-to-teacher ratios should be based on:

- Data collected from prekindergarten programs, including high-quality prekindergarten programs under Subchapter E-1, reported through the Public Education Information Management System (PEIMS); and
- Observations of best practices and examples from effective prekindergarten programs across the state.

This chapter addresses **Research Question 4** – What are the recommended optimal class sizes and student-to-teacher ratios for prekindergarten classes in Texas? Recommendations serve to inform the members of the Texas

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[103] See http://gov.texas.gov/news/press-release/20543 and http://www.capitol.state.tx.us/BillLookup/Text.aspx?LegSess=84R&Bill=HB4
[104] See http://tea.texas.gov/Curriculum_and_Instructional_Programs/Special_Student_Populations/Early_Childhood_Education/House_Bill_4_High-Quality_Prekindergarten_Grant_Program/ and 19 TAC §102.1003, 2016.
[105] See TEC § $29.1545 (2015) at http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.1545
[106] TEC § 25.111 (2015) does specify that each school district employ a sufficient number of certified teachers to maintain an average ratio of not less than one teacher for each 20 students in membership and through TEC § 25.112 (2015), LEAs are not to exceed the 22:1 ratio required for kindergarten through fourth-grade classrooms.
[107] See TEC § 25.112 (2015) at http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.112. See also TEC § 25.113 (2015) http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.25.htm#25.113 for class size exemptions.
[108] See TEC § 29.167(d) (2015) http://www.statutes.legis.state.tx.us/Docs/ED/htm/ED.29.htm#29.167

Legislature about how research and evidence can help them to make the best decisions as they consider future policy choices to enhance prekindergarten programs throughout Texas.

To determine recommendations for the optimal class sizes and student-to-teacher ratios for children in Texas public prekindergarten programs, the study team conducted a three-part study design that included:

1. A literature review to gather information from the latest research on optimal class size and student-to-teacher ratios.
2. Extant data analysis of TEA's available prekindergarten enrollment and kindergarten beginning of year (BOY) outcome data to describe prekindergarten programs in the state and identify prekindergarten programs on which to conduct observations.
3. Observations of 97 prekindergarten classrooms across 16 school districts and 32 campuses within the state to examine class size and student-to-teacher ratios and to identify potential best practices and examples from prekindergarten programs across the state.

Although the literature review was not required by TEC §29.1545 (2015), TEA and DFPS included it as a study component due to known limitations in the data system, timeline to conduct observations, and the added value it would bring to the analysis and recommendations. Through a combination of data and findings from the three study components, the study team addressed the overarching research questions using a mixed methods approach (i.e., mixing quantitative and qualitative data collection and analysis strategies).

The study limitations and the major study findings that provide the foundation for the recommendations are provided in the following section.

## Study Limitations

The three study components for arriving at recommendations include conducting a literature review, examining TEA data on class size and student-to-teacher ratio, and observations of prekindergarten classrooms. Each has limitations as well as strengths. More detailed limitations are presented in Chapter 2 for each study component; however, the following are some high level limitations the reader should keep in mind.

- As noted in the literature, many factors affect the quality of prekindergarten programs. This includes, but is not limited to, class size and student-to-teacher ratio. Most research on the quality of prekindergarten programs and student outcomes does not isolate class size and/or student-to-teacher ratios, thus affecting the ability to draw conclusions from the literature review. Leading national organizations as well as many state agencies have established basic guidelines such as those recommended by this study on this research.
- The second study component examined available extant data provided by TEA. TEA began collecting voluntary data submissions on prekindergarten students from districts in the 2014–15 school year using the Early Childhood Data System (ECDS). The study team and TEA agreed on a calculation for class size based on the 2014–15 school year data elements, but this calculation is expected to be more clearly defined in the future. It was also agreed that the currently available data from ECDS were insufficient to calculate student-to-teacher ratios.
- The third study component involved observations of classrooms selected with the intention of observing high-quality prekindergarten classrooms. The assumption was made that BOY kindergarten progress monitoring scores in 2015–16 were an indicator of the implementation of quality prekindergarten programs in 2014–15. Of course, not all children attending kindergarten had necessarily attended prekindergarten, and other reasons may explain the high BOY kindergarten progress monitoring scores. The potential sample was further limited to those districts that had participated in the voluntary ECDS data submission. While 97 classrooms at 32 campuses in 16 districts were observed in May 2016, this is a relatively small sample of all classrooms in the state of Texas.

# Recommendations

Research indicates that for children to be ready for kindergarten and to be successful in school, it takes a combination of structural and process components in the prekindergarten classroom. Structural components may include class size, student-to-teacher ratio, and teacher compensation. Process components may include quality of teacher child interactions, access to stimulating resources, and the types of activities in which a child is engaged. Both class size and student-to-teacher ratio influence the ability to provide effective process components. Furthermore, implementing a smaller class size without also addressing student-to-teacher ratios may decrease the potential positive impact on student outcomes. Therefore, our recommendations are presented in conjunction with one another because a class size standard that does not have an appropriate accompanying student-to-teacher ratio standard is unlikely to contribute to the conditions that greatly affect quality in the classrooms. Thus, based on the three study component findings it is recommended that

> *Class size guidelines should be set to a maximum not to exceed 22 students per prekindergarten classroom. Given the class size recommendation, a student-to-teacher ratio not to exceed 11:1 is recommended for all public prekindergarten classes with between 16 and 22 students. In cases where class size is 15 or fewer students, the student-to-teacher ratio should not exceed 15:1. However, following these guidelines alone will not ensure conditions for high-quality prekindergarten classrooms.*

School districts and open-enrollment charter schools should also consider the needs of their student populations as some populations may need smaller maximums to be effective. For example, programs serving students with special needs or English language learners may decide smaller class sizes and student-to-teacher ratios are most appropriate for best practice in their community. Following are findings from the study associated with making the recommendations.

## Class Size Recommendation

**Class size guidelines should be set to a maximum not to exceed 22 students per prekindergarten classroom.**

None of the early childhood education programs in the literature review that were associated with positive outcomes for children had a class size over 22. In fact, when the research focused on components of high-quality prekindergarten and other early childhood education programs, maximum class sizes were found to be between 18 and 22 students. Similarly, guidelines from national organizations on maximum class size are between 20 and 22 for four-year-olds (increasing to 20-24 for five-year-olds). The DFPS minimum standards for Texas early childhood education programs also vary by age group and allow for a maximum group (class) size of 35 and a maximum student-to-teacher ratio of 22:1. TEA currently recommends that prekindergarten programs not exceed class size of 22 students, consistent with the current requirement for kindergarten through Grade 4. *The State of Preschool 2015* reported that across the nation, 86% of all states met the quality standard for class sizes of 20 children or fewer. National reviews examining progress in specific states focused on high-quality prekindergarten education also consistently find guidelines that class size not exceed 20 students (e.g., Wechsler, 2016b).

The current guidance for Texas school districts or open-enrollment charter schools that offer high-quality prekindergarten programs established under the new High-Quality Prekindergarten Grant program to maintain an average ratio of not less than one certified teacher or teacher's aide for every 11 students is therefore supported by the literature reviewed. The extant data analysis indicates that the average class size of public prekindergarten programs in Texas was around 17 students. This suggests that many classrooms are already maintaining optimal class sizes that research demonstrates is associated with high quality, although no relationship between class size and CLASS PreK was found in the current observation study.

**Rationale**: The preponderance of evidence in the literature review suggests that class sizes in prekindergarten classrooms not exceed 20 students. This includes both the recommendations of professional organizations and reviews of class size guidelines from other states, particularly those associated with a focus on quality prekindergarten education. Still, at least some professional organizations suggest that classrooms with as many as 22 students may also be associated with quality. In addition, the majority of the research is primarily theoretical rather than evidence-based studies designed to identify a single class size. The study team thinks the research to date suggests that a class size not exceeding 22 students may be as likely to support quality as one with 20 students. In addition, the recommendation not to exceed a class size of 22 students is in line with what actual class sizes were for the large number of Texas public prekindergarten classrooms that voluntarily submitted ECDS data. Specifically, an examination of ECDS 2014–15 data including data from just over 3,000 classrooms found an average class size of 17 students in Texas public prekindergarten programs and that 72% of the programs had class sizes of 20 or fewer students while 87% had class sizes of 22 or fewer students. This suggests that, should the state establish clearer standards with regard to class size, a small number of prekindergarten programs would need to change from current practice. Finally, the observation component of this study similarly suggested that most prekindergarten programs had class sizes of 22 students (80%), and none of the class sizes were larger than 29 students. Among observed classrooms scoring the highest on each quality rating domain, class size ranged from 13 (for classrooms rated highest on Instructional Support) to 18 (for classrooms rated highest on Emotional Support). That is, higher quality scores occurred in classrooms with generally smaller average class sizes. While across all observations there was not a significant linear relationship between class size and CLASS PreK scores, this may be related to the small sample size and limited class sizes within the sample (from class size of 3 to 29 maximum).

## Student-to-Teacher Ratio Recommendation

**Given the class size recommendation, a student-to-teacher ratio not to exceed 11:1 is recommended for all public prekindergarten classes with between 16 and 22 students. In cases where class size is 15 or fewer students, the student-to-teacher ratio should not exceed 15:1.**

The literature review indicates that early childhood education classrooms associated with positive outcomes for children did not exceed a student-to-teacher ratio over 11:1. When the research focused on components of high-quality prekindergarten and other early childhood education programs, the student-to-teacher ratios were between 8:1 (15:2) and 11:1 (22:2).[109] The national guidelines for student-to-teacher ratios vary by age group (3 years and 4 to 5 years of age) and are between 7:1 and 12:1 for student-to-teacher ratios. The mandates and guidelines for Texas early childhood education programs also vary by age group and are between 9:1 and 22:1 for student-to-teacher ratio, including Texas's new High-Quality Prekindergarten Grant program, which recommends prekindergarten programs maintain an average student-to-teacher ratio of not less than one certified teacher or teacher's aide for every 11 students in their classrooms. The *State of Preschool 2015* reported that across the nation, 88% of all states met the quality standard of 10 children for 1 adult per classroom. In examining student-to-teacher ratios in states considered comparable to Texas, student-to-teacher ratios between 8:1 and 10:1 were reported.

Based on the analysis of prekindergarten classroom observation data from 97 classrooms at 32 campuses in 16 districts across the state, there was little evidence of a linear relationship between class size and student-to-teacher ratios and CLASS PreK scores for Emotional Support, Classroom Organization, and Instructional Support domains (and their related dimensions). That is, when class size or student-to-teacher ratios increased, there was not a corresponding decline in the quality of teacher-student interactions. However, when student-to-teacher ratios were separated by a threshold of 15:1, statistically significant differences in the average CLASS PreK scores were observed. Classrooms with student-to-teacher ratios of 16:1 and higher had significantly lower overall CLASS PreK scores, as well as Emotional Support and Instructional Support domain scores, than classrooms with ratios of 15:1 or less, which suggests that quality interactions may be less likely to occur in the classrooms with the ratios of 16:1 and higher. In classrooms with ratios of 15:1 and lower, several best practices were observed including more analysis

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[109] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, repetition and extension.

Although the student-to-teacher ratio of 15:1 or less from the classroom observation data is higher than the ratio suggested by research (no more than 11:1), both may be associated with high quality and positive child outcomes based on the observation study. The range of 11:1 to 15:1 student-to-teacher ratios provides Texas prekindergarten classrooms the opportunity for progressing towards lower student-to-teacher ratios. Furthermore, the study team recommends that once a class size of 16 is achieved, the classrooms need at least two teachers or one teacher and an educational aide.

**Rationale**: The recommended class size of 22 is likely to be insufficient to support quality if a student-to-teacher ratio of 11:1 or better is not also established. The preponderance of literature suggests that prekindergarten classrooms not exceed student-to-teacher ratios of 10:1 to 11:1 for high-quality classrooms. When the research focused on components of high-quality prekindergarten and other early childhood education programs, the student-to-teacher ratios were between 8:1 (15:2) and 11:1 (22:2).[110] Student-to-teacher ratios were not available for the ECDS sample included in this study, so it is unknown to what extent Texas public prekindergarten classrooms on average were meeting or close to meeting this recommendation in the 2014–15 school year.

The observation component of this study occurred in only 97 classrooms, but provided additional guidance on student-to-teacher ratios. Specifically, in the sample of observed classrooms, the average student-to-teacher ratio was 12:1, only slightly higher than the recommendation. In approximately one-third of observed classrooms, there was only teacher in the classroom throughout the time the classroom was observed although it is unknown to what extent this end-of-year observation reflected typical student-to-teacher ratios from throughout the school year. In addition, when student-to-teacher ratios were separated by a threshold of 15:1, statistically significant differences in some of the average CLASS PreK scores were observed. That is, classrooms with student-to-teacher ratios of 15:1 or less were associated with higher quality than classrooms with higher student-to-teacher ratios. In classrooms with ratios of 15:1 and lower, several best practices were observed including more analysis and reasoning, creation, integration, connections to the real world, encouragement and affirmation, feedback loops, provision of information, scaffolding, advanced language use, open-ended questions, and repetition and extension.

## Additional Research Suggested

In conclusion, the limitations mentioned in this chapter suggest the need for additional rigorous longitudinal research to determine the relative contributions of various classroom quality factors, including class size and student-to-teacher ratio on child outcomes from prekindergarten to Grade 3 and possibly beyond. It also suggests the need for additional examination of the ECDS data collected as a result of new requirements to be reported in the ECDS starting in May 2017. These data should be tracked over time and aligned with indicators of classroom quality to continue to inform the relationship between structural components, process components, and quality.

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[110] A 15:2 student-to-teacher ratio is equivalent to 7.5 students per one teacher, which is rounded to 8:1 in this report.

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# Appendix A: Study Design and Methods

This appendix describes details about how data were collected and analyzed for each of the three study components that included: (1) conducting a literature search and review to gather information from the latest research on optimal class size and student-to-teacher ratio; (2) analyzing the Texas Education Agency's (TEA) extant data; and (3) observing 97 prekindergarten classrooms to identify best practices and examples from prekindergarten programs across the state. Table A.1 shows the data sources and analyses used to answer the study questions, followed by data collection and analyses methods for the literature review, observational data, and extant data.

**Table A.1: Analysis Plan Matrix**

| Study Questions | Data Sources | Planned Analyses |
|---|---|---|
| 1. What is the current status of class size and student-to-teacher ratio in prekindergarten programs in Texas? | ▪ TEA Extant Data<br>▪ Literature Review<br>▪ Observations | ▪ Descriptive Statistics (i.e., means, standard deviations, correlations)<br>▪ Thematic Analysis |
| 2. In what ways do prekindergarten class size and student-to-teacher ratio relate to students' school readiness and academic performance? | ▪ TEA Extant Data<br>▪ Literature Review<br>▪ Observations | ▪ Descriptive Statistics (i.e., means, standard deviations, correlations)<br>▪ Thematic Analysis |
| 3. What are some best practices and examples from quality prekindergarten programs pertaining to class size and student-to-teacher ratio? | ▪ Literature Review<br>▪ Observations | ▪ Descriptive Statistics (i.e., means, standard deviations, correlations)<br>▪ Thematic Analysis |
| 4. What are the recommended optimal class sizes and student-to-teacher ratios for prekindergarten classes in Texas? | ▪ TEA Extant Data<br>▪ Literature Review<br>▪ Observations | ▪ Combination of findings from across study components |

## Literature Search and Review

This section describes the research questions that guided the literature review, the literature search parameters, and the methods for analyzing the research articles. The sources and key data fields used in the literature review analysis are provided in Table B.1 in Appendix B.

### Guiding Questions

The literature review focused on four guiding research questions:

1. What policies or guidance do national organizations, other states and/or large-scale program evaluations provide regarding prekindergarten-age class sizes and student-to-teacher ratios? What were their reasons for selecting these sizes and ratios? Specifically, what information can be learned from states of comparable size and student population, such as California, Florida, and New York?
2. What does the empirical research reveal to be optimal class sizes and student-to-teacher ratios for implementing developmentally appropriate practices in prekindergarten programs? What is the quality of the research?
3. What research exists pertaining to class size and student-to-teacher ratios in settings similar to Texas public prekindergarten settings (e.g., in public schools, serving children meeting criteria of TEC § 29.153, 2015)?
4. To what extent are class size and student-to-teacher ratios independent factors in overall quality of prekindergarten programs and to what extent are these factors intertwined with other aspects of quality (e.g., Emotional Support, Classroom Organization, Instructional Support)?

## Literature Search and Review

In order to gather relevant literature, the study team first established search parameters and key search terms to identify the most relevant and recent research specific to prekindergarten class size, student-to-teacher ratio, and components of high-quality early education programs. While the primary focus was on research and reports from the past 10 years (2006-2016), the study team also included seminal or landmark studies prior to 2006 if they examined components of high-quality early education programs. We only limited our searches to research conducted in the United States as this study pertains to Texas prekindergarten programs. For this reason, we also focused on studies and evaluations of prekindergarten programs that had child populations similar to those served by TEA prekindergarten programs (students identified as economically disadvantaged, English Language Learners and children of active duty Military) and preschool age children served in subsidized child care and Head Start. We determined that California, Florida, and New York had the most similar characteristics as Texas so looked specifically at those states for a comparative analysis of their publicly-funded prekindergarten programs.

The search terms used to conduct the literature review included class size, group size, student-to-teacher ratio, teacher-child ratio, high-quality early childhood, prekindergarten, and quality indicators in preschool. Search engines used to identify relevant literature included, EBSCOHost, and Google Scholar. In addition to these databases, the study team searched websites of early childhood research and policy organizations, universities, and non-profit research organizations.

The preliminary review yielded approximately 50 studies relevant to class size, student-to-teacher ratio and components of high-quality early childhood education. Once we conducted a preliminary review, we organized sources as primary sources (empirical research), secondary sources (reviews of empirical research), and other sources (magazines, news articles, and policy and position papers).

## Search Results and Analysis

The search yielded over 50 articles. The study team maintained information about each article in an Excel Workbook, which was used in the review and analysis of the articles. The information included:

- Author(s) name(s)
- Publication year
- Title of article (include web link if applicable)
- Name of journal/volume/number/page numbers (include web link if available)
- Research question(s) in study
- Research design
- Program type
- Are any programs in the study full-day or part-day programs
- Sample size
- Age of children in study (3 or 4)
- Race/ethnicity of children in classroom
- Study location (state)
- Urbanicity of study location
- Tool(s) used in the study
- Study limitations/methodological strengths/weaknesses
- Landmark study (yes or no)
- Qualitative or quantitative
- Ratio in study
- Class size in study
- Findings

The summary of findings from the literature review were used to provide the context for this study, describe the significance and benefits of high-quality early childhood education programs for children and the larger society, describe how high-quality programming is operationalized in early childhood education research and the limitations of this research, and summarize the data on class sizes and student-to-teacher ratios. It is important to note that data on class sizes and student-to-teacher ratios reported in the literature come primarily from research studies that include these two components along with several other components of high-quality early childhood education program. That is, these research do not examine the unique contributions of class size and student-to-teacher ratio on child outcomes. A smaller number of research studies primarily focused on the relationships between class size and student-to-teacher ratio and child outcomes. Another major source for class sizes and student-to-teacher ratios are national and state guidelines.

The results from the literature review provided the strongest foundation for recommendations because the literature review considered a wide body of research whereas the extant data analysis and observation data had limitations outside of the study's control.

# Extant Data Analysis

This component of the study addressed applicable research questions through analysis of extant data, relying primarily on two TEA extant data systems, the Early Childhood Data System (ECDS) and the Public Education Information Management System (PEIMS).

## Early Childhood Data System

The ECDS is a new reporting system within the Texas Student Data System used by districts for the first time in the 2014–15 school year to collect prekindergarten and kindergarten data per TEC § 29.161 (2015).[111] Districts first reported prekindergarten data into the system in March of 2015 at which time they could voluntarily report this data for three school years (i.e., 2012–13, 2013–14, and 2014–15).[112] In October of 2015, districts using one of the commissioner's approved reading progress monitoring instruments were also required to report the 2015–16 beginning of year (BOY) kindergarten progress monitoring data into ECDS (TEC § 28.006, 2015).[113] ECDS data that were relevant and available for inclusion in this study included 2014–15 prekindergarten data and 2015–16 BOY kindergarten progress monitoring data. The limitations of the ECDS at the time this study was conducted should be considered to understand how ECDS data were used in this study.

### ECDS LIMITATIONS

The data available in ECDS were limited for the purposes of this study in the following ways:

- Reporting prekindergarten data was voluntary for districts, with only approximately 18% of school districts reporting data for prekindergarten in the 2014–15 school year. That is, only a small sample of all Texas districts reported prekindergarten data for this school year.
- Data elements in the ECDS were in the process of being revised during this study to meet data reporting requirements established in House Bill 4 (83rd Texas Legislature) which will be in place for the 2016–17 school year. For this report, the study team and TEA agreed on a calculation for class size based on the available

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[111] ECDS replaced the Kindergarten Readiness System at this time.

[112] For information on the March 2015 ECDS prekindergarten data collection see
http://tea.texas.gov/About_TEA/News_and_Multimedia/Correspondence/TAA_Letters/Early_Childhood_Data_System_(ECDS)_for_Prekindergarten/

[113] For information on the October 2015 ECDS kindergarten BOY kindergarten progress monitoring data and the list of the commissioner's approved reading progress monitoring instruments see
http://tea.texas.gov/About_TEA/News_and_Multimedia/Correspondence/TAA_Letters/Early_Childhood_Data_System_(ECDS)_and_Compliance_with_Kindergarten_Reading_Assessment_Data_Submission_(TEC,_%C2%A728_006)/ and
http://tea.texas.gov/uploadedFiles/Curriculum/English_-_Language_Arts/attachments/Commissioner's%20List%20of%20Reading%20Instruments%202014-2015.pdf

2014–15 school year ECDS data elements, but the data elements needed to calculate class size more precisely will be available in the future. It was also agreed that the currently available data from ECDS were insufficient to use to calculate student-to-teacher ratios.

♦ While ECDS data contained a teacher record linked to each student, districts were not asked to enter all teachers and education assistant records associated with the student. Therefore, the number of adults in a classroom could not be determined, making it impossible to reliably calculate student-to-teacher ratios.

♦ A classroom-to-teacher link (or classroom ID) to generate class size was not available. Therefore, classroom size was calculated by associating teachers and students. Class sizes within districts that did not submit ECDS prekindergarten data remain unknown.

▪ Data reporting errors may not have been identified in the ECDS for the 2014–15 school year due to a lack of systematic data validation built into the system. Data validation checks are part of the 2016–17 ECDS revisions.

Beginning in the 2016–17 school year, several changes will occur to the ECDS data system that will facilitate further study on class sizes and student-to-teacher ratios in public prekindergarten programs across the state. All districts will be required to report to TEA additional data elements for public prekindergarten programs at the district and campus level through a PEIMS/ECDS hybrid collection as part of the broader Texas Student Data System.[114] Improved collection methods will also eliminate duplication in data entry and result in more robust data entry. Existing and new data elements to be reported beginning in the 2016–17 school year will provide the following:

▪ demographic information on students enrolled in district prekindergarten classes, including the number of students who are eligible for classes under TEC § 29.153,
▪ the numbers of half-day and full-day prekindergarten classes offered by the district and campus,
▪ the sources of funding for the prekindergarten classes,
▪ class size,
▪ instructional staff-to-student ratio and the ability to link students to teachers,
▪ the type of curriculum, and
▪ the type of prekindergarten progress monitoring tool and results (if administered).

### PREKINDERGARTEN DATA

ECDS data includes prekindergarten student demographics, program instruction type (e.g., full-day, half-day), and teacher information (e.g., teacher name) for all four-year old kindergarten bound students that were enrolled in a program for four or more months during the school year.[115] The data used in the analysis for this component of the study included teacher and student data and instruction type.[116] It was anticipated that the prekindergarten data could be used to calculate class size and student-to-teacher ratio, the focus of this study; however the study team encountered several challenges when processing the ECDS prekindergarten data. For example, although districts were told to only report in the teacher of record for any given student, some districts reported in multiple teachers for the same teacher. Additionally, in some cases the same teacher was associated with what appeared to be multiple classrooms or even multiple campuses. Given the variables required to link teachers to classrooms and establish a unique student-to-teacher link were not available in ECDS at this time, TEA and the study team agreed that the data were insufficient to calculate student-to-teacher ratio. Although ECDS did not contain a classroom ID variable, which would have made it possible to categorize all students into unique classrooms, each student was associated with one or more teachers. Therefore, the decision was made that it was possible to calculate class size but only after completing several data cleaning steps to ensure that students in the remaining dataset were associated with the

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[114] See http://castro.tea.state.tx.us/tsds/teds/2017A/Section102016_2017.pdf and http://www.texasstudentdatasystem.org/

[115] There were a small number of cases in which districts reported in multiple teachers instead of a single teacher of record, these cases were kept if it could be reliably determined that these teachers were associated with the same group of students and students were always associated with this same group of teachers.

[116] See http://castro.tea.state.tx.us/tsds/teds/2013F/v1.0/ds10/teds-ds10.ecdsv1.0.pdf and http://www.texasstudentdatasystem.org/TSDS/TEDS/1415A/TEDS_Section_10_-_TSDS_Core_Collections/ for the 2014–15 ECDS data standards.

same teacher (or teachers) and that teacher (or teachers) was always associated with the same group of students. Table A.2 provides a summary of decisions used to exclude cases from the class size calculations along with the number and percentage of cases excluded by each decision.

**Table A.2: Number and Percentage of Early Childhood Data System Cases Excluded from Class Size Calculations (2014–15 Prekindergarten Data)**

| Reason for Excluding Case | Number of Records | Percentage of Records (n=58,333) |
|---|---|---|
| Students with no associated teacher ID | 1,086 | 1.9% |
| Teacher ID associated with multiple campuses | 235 | 0.4% |
| Teacher ID associated with more than one pattern of students (e.g., five students associated with teacher A, and another seven students associated with teacher A and teacher B) | 5,141 | 8.8% |
| Students with no instruction type | 1,474 | 2.5% |
| **Total** | **7,936** | **13.6%** |

After cleaning, the ECDS 2014–15 school year sample included data from 15% of all districts (23% of all campuses) with prekindergarten programs. Approximately one fifth (21%) of all prekindergarten students in the state (as reported in PEIMS, see below) were represented in the cleaned ECDS 2014–15 school year sample. After data cleaning, class size was calculated with the remaining ECDS 2014–15 prekindergarten data. Specifically, class size was defined as the number of students with the same instruction type (e.g., full-day, half-day morning, or half-day afternoon) under the same teacher or the same group of teachers. For classrooms containing both full-day and half-day students (mixed instruction types), class size was defined by the potential maximum number of students during the day. For example, if a teacher was associated with 10 students attending full-day programming, 5 students attending half-day morning programming and 3 students attending half-day afternoon programming, the class size would be 15, since the maximum number of students in this class during the day is 15 (10 full-day plus 5 half-day morning).

## PEIMS Prekindergarten Data

In addition to ECDS data, the study team received statewide PEIMS data for prekindergarten students. While reporting in ECDS is voluntary, all districts must submit PEIMS data for their prekindergarten students. It was determined neither prekindergarten class size nor student-to-teacher ratios could be reliably determined from PEIMS data so only the demographic data about prekindergarten students in the 2014–15 and 2015–16 school years were used in this study. These data were used to compare the representativeness of the ECDS sample of data to the Texas prekindergarten population demographically.

## Analyses of Extant Data

The primary analyses of ECDS data were descriptive. Specifically, a descriptive analysis was conducted to summarize the current status of class sizes for the ECDS sample using common statistics, such as mean, median, mode, minimum, and maximum. In addition, the percentages of prekindergarten classrooms that fell above national standards and the recommendations for class size in this report were provided in order to understand the extent to which Texas prekindergarten programs were within those standards in the 2014–15 school year.

As noted, one of primary limitations of the ECDS data was the small sample size. Due to voluntary data submission for prekindergarten programs, the ECDS sample contains only a fraction (21%) of the entire prekindergarten student population in Texas. To evaluate the representativeness of the ECDS sample, the study team compared it demographically with the PEIMS data for the same school year (2014–15). Because PEIMS data represent the population, all differences between the ECDS sample and PEIMS were compared descriptively. If the percentage of students in a specific demographic category in ECDS (e.g., males) was larger or smaller than the percentage of the

same group of students in the PEIMS data, this may suggest findings may not generalize to the given group of students (e.g., males).

# Observation Data Collection and Analyses

This section describes the methodology, including site selection, data collection, and analyses for the observation study component. (Note: Technical findings from the observation are included in Appendix C; vignettes are provided in Appendix D, and samples of best practices are provided in Appendix E.)

### BEGINNING OF YEAR KINDERGARTEN PROGRESS MONITORING DATA

ECDS 2015–16 BOY kindergarten progress monitoring data were of interest to the study team for selecting sites to observe. The goal of the observation site visits was to visit prekindergarten classrooms that were potentially high-quality in order to observe class size and student-to-teacher ratio as associated with quality practices. However, there was no clear marker of prekindergarten quality that was available to the study team. Given that one goal of high-quality prekindergarten programs is to improve kindergarten readiness, the decision was made to examine 2015–16 BOY kindergarten progress monitoring data. That is, at least one explanation for differences in kindergarten readiness (as measured using the BOY kindergarten progress monitoring instruments) was that students had participated in high-quality prekindergarten programs. While the 2015–16 kindergarten students presumably attended prekindergarten in 2014–15, it was assumed that if the prekindergarten program was high-quality, that level of quality was maintained in the 2015–16 school year. At the time of site selection, as described in the following section, campus level data on the percentage of students who entered kindergarten school ready based on BOY of kindergarten progress monitoring data were available. After observations were complete, the type of kindergarten progress monitoring tool used and the student's score on that assessment, as well as demographic data, were provided.

## Site Selection Steps

Campus-level aggregated ECDS 2015–16 BOY kindergarten progress monitoring data were used to identify potential high-quality sites for the observation study in order to conduct site visits across the state. Selection needed to occur quickly in order for site visits to be conducted before the end of the 2015–16 school year. All site visits were conducted in May 2016.

Specifically, the multi-step process for selecting sites was as follows:

1. Identified districts with both 2014–15 ECDS prekindergarten data and kindergarten BOY progress monitoring data from fall of the 2015–16 school year. This limited the sample to the subgroup of schools that submitted ECDS prekindergarten data (a small subsample of all Texas public prekindergarten programs), but ensured that all sites visited had a public prekindergarten program.

2. Converted campus-level BOY kindergarten progress monitoring scores to a z-score, a standard score that shows how many standard deviations an element is from the mean, to enable a comparison of scores from different progress monitoring tools using the same scale. Average z-scores were calculated for each campus (for those that used multiple progress monitoring tools) by first calculating a z-score for each progress monitoring tool then averaging all z-scores at that campus. This resulted in one z-score per campus. Higher z-scores reflected higher BOY scores on kindergarten readiness indicators.

3. Sorted campuses by district into the six geographic regions (i.e., Dallas-Fort Worth, Houston/Gulf Coast, Central Texas, South Texas, San Antonio, and West Texas) and ranked them from highest to lowest z-score.

4. Across all campuses in the state, the top approximately 25% had z-scores of .635 or higher. The actual distribution varied by region, but within each of the six regions, districts at which there were campuses with z-

scores of .6 and higher were identified. Overall z-scores of .635 and above identified the top scoring 25–27% of campuses within each of the six geographic regions. By using z-scores of .6 or above, a sufficient number of districts were identified for the site selection. District proximity to other districts in each region was also considered in the selection of districts within regions to make it possible to conduct multiple site visits in a short timeframe.

5.  Within the selected districts, campuses were selected based on z-score and number of teachers. Specifically, the first two (or three, based on the proposed distribution) rank-ordered campuses that had three or more teachers were selected. In some cases, there were not enough campuses with three or more teachers, in which case the campus with the highest z-score in that district was selected. When the initial sample was exhausted additional districts were selected. These sites also met the criteria of a z-score of .6 or higher. Selecting campuses with multiple teachers further facilitated the goal of conducting the desired number of site visits within the short timeframe available before the end of the school year.

6.  The selected districts, campuses, and teachers also had to agree to voluntarily participate in having their prekindergarten classrooms observed.

## Description of Observation Protocol

The study team observed the selected classrooms using the Classroom Assessment Scoring System for Prekindergarten (CLASS® PreK) to assess quality.[117] CLASS PreK is an observation tool that measures the classroom interactions that have been associated with improvements in student learning in prekindergarten classrooms.[118] It has been used extensively for both research and professional development (PD) purposes. Additionally, data from CLASS PreK observations have been used to set school-wide goals and shape system-wide policy at the local, state, and national levels. Based on research from the University of Virginia's Curry School of Education and studied in thousands of classrooms nationwide, CLASS PreK:

- Focuses on effective teaching;
- Helps teachers recognize and understand the power of their interactions with students;
- Aligns with professional development tools; and
- Works across age levels and subjects.

For this study, the CLASS PreK was used as the observation tool to measure early childhood classroom quality by focusing on adult-child interactions across three primary domains: Emotional Support, Classroom Organization, and Instructional Support. Trained observers utilized a seven-point scale to rate student-to-teacher interactions on ten different dimensions: (1) four Emotional Support dimensions, (2) three Classroom Organization dimensions, and (3) three Instructional Support dimensions.

Each of the ten CLASS PreK dimensions is described after each domain heading (Pianta, La Paro, & Hamre, 2015).

### EMOTIONAL SUPPORT DOMAIN

- *Positive Climate*: This is the emotional connection, respect, and enjoyment demonstrated between teachers and students and among students. When scoring this dimension, observers assess the following indicators: relationships, positive affect, positive communications, and respect.
- *Negative Climate*: This is the level of expressed negativity, such as anger, hostility, or aggression, exhibited by teachers and/or students in the classroom. When scoring this dimension, observers assess the following indicators: negative affect, punitive control, sarcasm/disrespect, and severe negativity.

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[117] See http://teachstone.com/classroom-assessment-scoring-system/age-levels/age-levels-pre-k/
[118] *Ibid*

- **Teacher Sensitivity**: This is teachers' awareness of and responsivity to students' academic and emotional concerns. When scoring this dimension, observers assess the following indicators: awareness, responsiveness, addresses problems, and student comfort.
- **Regard for Student Perspectives**: This is the degree to which teachers' interactions with students and classroom activities place an emphasis on students' interests, motivations, and points of view. When scoring this dimension, observers assess the following indicators: flexibility and student focus, support for autonomy and leadership, student expression, and (lack of) restriction of student movement.

### CLASSROOM ORGANIZATION DOMAIN

- **Behavioral Management**: This is how effectively teachers monitor, prevent, and redirect behavior. When scoring this dimension, observers assess the following indicators: clear behavioral expectations, proactive (behavioral management), redirection of misbehavior, and student behavior.
- **Productivity**: This is how well the classroom runs with respect to routines and the degree to which teachers organize activities and directions so that maximum time can be spent in learning activities. When scoring this dimension, observers assess the following indicators: maximizing learning time, routines, transitions, and teacher preparation.
- **Instructional Learning Formats**: This is how teachers facilitate activities and provide interesting materials so that students are engaged and learning opportunities are maximized. When scoring this dimension, observers assess the following indicators: effective facilitation, variety of modalities and materials, student interest, and clarity of learning objectives.

### INSTRUCTIONAL SUPPORT DOMAIN

- **Concept Development**: This is how teachers use instructional discussions and activities to promote students' higher-order thinking skills in contrast to a focus on rote instruction. When scoring this dimension, observers assess the following indicators: analysis and reasoning, creating, integration, and connections to the real world.
- **Quality of Feedback**: This is how teachers extend students' learning through their responses to students' ideas, comments, and work. When scoring this dimension, observers assess the following indicators: scaffolding, feedback loops, prompting thought processes, providing information, and encouragement and affirmation.
- **Language Modeling**: This is the extent to which teachers facilitate and encourage students' language. When scoring this dimension, observers assess the following indicators: frequent conversation, open-ended questions, repetition and extension, self- and parallel-talk, and advanced language.

Each member of the study team who observed prekindergarten classrooms attended a two-day training in Austin and was certified as a reliable CLASS PreK observer before conducting observations. Reliability for the instrument means that it is expected that two researchers observing the same period of instruction will provide ratings within one point of each other on each of the ten CLASS PreK dimensions. Following their observations of teacher-child interactions, CLASS PreK observers rated each dimension on the following seven-point scale:

- Scores of 1–2 were assigned to classrooms where the quality of teacher-child interactions was low. Classrooms in which there was substandard management of behavior, instruction that was rote in nature, or the lack of interaction between teachers and children received low scores.
- Scores of 3–5, the mid-range, were provided when classrooms showed a mix of effective teacher-student interactions with periods when interactions were not effective or were absent.
- Scores of 6–7 were assigned to classrooms where effective teacher-child interactions were consistently observed throughout the observation period.

While onsite, observers completed three 12-minute observation cycles in each of the 97 classrooms using the CLASS PreK to score each of the ten dimensions based on observed behaviors on a number of key indicators (see

Table 2.8).[119] To condense the three observations of each teacher into an average score for the classroom, the study team created a unique identifier for each lead teacher by combining the teacher's name, date of observation, and campus.[120] The average number of students, number of adults (i.e., teachers and/or educational aides), and dimension-level CLASS PreK scores were then calculated for each teacher in order to arrive at a single metric for each variable.[121] In addition, observers took detailed field notes that were used in the scoring of each segment observed. The field notes also served to document best or promising practices used by prekindergarten teachers across the state, in relation to each of the CLASS PreK dimensions.

## Limitations

The following limitations related to the selection of sites for inclusion in the observations and observational data should be taken into account:

- The initial selection of sites to be included in the observation sample was limited to only those districts which submitted ECDS 2014–15 prekindergarten enrollment data and 2015–16 beginning of year progress monitoring data for kindergarten students. This substantially limited the number of public prekindergarten programs that could be selected for observation relative to all programs in the state since ECDS prekindergarten data submission for 2014–15 was voluntary.
- As previously noted in the examination of extant data, ECDS data appropriate for calculating student-to-teacher ratios were not available. Student-to-teacher ratios at the observed sites were unknown until the time of the observation. This constraint limited the study team's ability to stratify the sample by class size or student-to-teacher ratio, which may have aided in the subsequent analyses comparing quality as measured by CLASS PreK by class size and student-to-teacher ratio.
- The statute called for observations of best practices and examples from effective prekindergarten programs across the state (see section on Site Selection for additional information). Briefly, kindergarten campuses were rated on quality based on ECDS 2015–16 school year BOY kindergarten progress monitoring data and the assumption was made that one contributor to higher levels of kindergarten (school) readiness was high-quality prekindergarten programs. Given that not all children who attend kindergarten attended prekindergarten public school at the same campus (and some students may not have attended any early childhood program outside the home), it is possible that some campuses selected for observation were not actually high-quality.[122]
- Even if all students did attend a campus's prekindergarten program, students' performance on BOY kindergarten progress monitoring was also potentially influenced by many other important factors (e.g., teacher quality, school environment, family socioeconomic status), which was not considered in the site selection process due to unavailable data.
- Different types and versions of kindergarten progress monitoring tools were used by schools, which had varying standards and definitions for school readiness.[123] In addition, the kindergarten progress monitoring data were collected at the beginning of kindergarten after students had completed prekindergarten. There was no comparable prekindergarten BOY progress monitoring data that could be used to determine if students in these programs started prekindergarten at a higher level relative to students not attending one of the observation site programs.
- Classroom observations occurred in May 2016 (i.e., during the 2015–16 school year). The assumption was made that the prekindergarten program maintained high quality into the 2015–16 school year. However, organizational, instructional, and staffing factors which may have contributed to quality as indicated by students'

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[119] While observation cycles of 20 minutes are optimal, those of over 10 minutes in duration are valid as per CLASS guidelines. It was necessary to reduce the observation time slightly to fit in three observations cycles followed by eight minutes of CLASS coding. This allowed each classroom to receive three independent CLASS scores for each of the ten dimension to improve the reliability of CLASS scores.

[120] All three observation cycles occurred on the same day for each classroom.

[121] The number of students, number of adults (used in student-to-teacher ratio calculations) and the CLASS PreK dimension-level observations scores were averaged across the three periods observed for each classroom.

[122] Student level school readiness data became available after completion of site selection and are presented in later sections (see Table 2.10).

[123] All of the progress monitoring tools were approved by TEA for the purposes of assessing kindergarten readiness.

school-readiness from 2014–15 to 2015–16 may not have be in place in 2015–16. The timeline of the current study did not allow for following the 2015–16 prekindergarten students into kindergarten during the 2016–17 school year to examine if school readiness was maintained at high levels.

- Scheduling and conducting classroom observations were done on a tight timeline in the final month before the school year ended (May 2016), including one full week when no observations were conducted due to state testing (May 9–13). Observations conducted at the very end of the school year, particularly the final week of school, may not be reflective of the teaching and learning that took place in those classrooms earlier in the spring 2016 semester.

- The student-to-teacher ratio and class size analyses included in this section examine the relationship between class size, student-to-teacher ratios, and CLASS PreK observation scores without controlling for teacher characteristics. That is, observation scores for a classroom may be related to the background, training, and pedagogical skills of teachers, rather than the student-to-teacher ratio or the class size. It is also possible that some of the observation sub-scores (e.g., productivity) may not be related to student-to-teacher ratios or class size.

- Lastly, conclusions about the relationship between class size, student-to-teacher ratio and CLASS PreK observation scores should be viewed with caution due to the relatively small number of classroom observation sample ($n$ = 97 classrooms from 32 campuses in 16 districts). This caution is further extended to analyses which further segment the 97 observations based on student-to-teacher ratios (e.g., comparison of 64 classrooms with 15:1 ratios or lower to 23 classrooms with ratios of 16:1 or more). The findings observed in this sample for a given class size group or student-to-teacher ratio may not be generalizable to all classrooms with the same characteristics.

## Analyses of Observation Data

Analyses of the observation data included descriptive statistics, correlation analyses, and t-tests.

### DESCRIPTIVES

To shed light on the potential generalizability of findings from sites included in the classroom observation sample, the study team conducted several analyses to generate high-level student demographic characteristics of the observed sites and review whether the observed sites were similar to the overall Texas public prekindergarten population. Specifically, PEIMS data for the sample from the year observed (2015–16) were compared to all Texas public schools based on prior year data (2014–15 school year) and to the ECDS sample demographics from the prior year (2014–15 school year). Specific demographics compared included the percentage of students by gender, and the percentages identified as Hispanic, as economically disadvantaged, as English language learners and as special education.

Second, to verify that the sites selected for observation were relatively high on school readiness, the study team used the student-level 2015–16 BOY kindergarten school readiness indicators to calculate the school readiness rate for prekindergarten students enrolled in the observed sites during 2014–15 and compared it with the entire ECDS sample.[124] Finally, the average size of observed classrooms based on ECDS data for the 2014–15 school year was compared to class size estimates obtained while onsite in May 2016 observing instructional practices of prekindergarten teachers. This was again a descriptive comparison of mean, median, minimum, and maximum class size.

For each of the 97 prekindergarten classrooms observed, three segments of 12 minutes were observed and scored using the CLASS PreK observation tool. In addition, in each of the three observed time periods, the number of adults providing instruction (i.e., teachers and education aides) and the number of students present during the observation

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[124] Student-level data allowing calculation of a school ready status were not available during site selection but were available in time to include this analysis in the report.

were recorded. For each of the ten CLASS PreK dimensions, scores for the three time periods observed were averaged to create a single average CLASS dimension score for each classroom.[125] Dimension-level scores were then averages for each classroom to arrive at a single domain-level score for the Emotional Support, Classroom Organization, and Instructional Support domains. Average class size and student to teacher ratios were calculated in a similar manner to calculate a single class size and student-to-teacher ratio per classroom.

To assess the descriptive relationship between class size and student-to-teacher ratios, and CLASS PreK scores, the evaluation team relied on a series of correlational and descriptive analyses. All 97 observed classrooms were included in these analyses.

Correlational analyses were conducted to assess the linear relationship between class size and student-to-teacher ratios and the following four CLASS PreK scores: 1) Emotional Support; 2) Classroom Organization; 3) Instructional Support; and 4) Overall CLASS PreK score. Correlation coefficients of less than .3 are considered to be weak in nature. To further explore the linear relationships between class size and student-to-teacher ratios and CLASS PreK scores, scatterplots were prepared as visual representations of these relationships.

Descriptive analyses involved the organization of classrooms into quartiles according to the number of students present (i.e., class size), and the student-to-teacher ratio for the classroom. Then average domain-level and overall CLASS PreK scores were calculated for each of the quartiles. These data were described descriptively, and t-tests were used to determine if statistically significant differences in average scores were found. Because of the large difference in CLASS PreK scores observed between the fourth quartile of student-to-teacher ratios (with ratios above 15:1) and the other three quartiles, t-tests were calculated to determine if significant differences in CLASS PreK domain scores persisted for classrooms with ratios above 15:1 when compared to classrooms with ratios of 15:1 or lower. To test the sensitivity of this level, the same calculations were conducted at 11:1, 12:1, 13:1, and 14:1.

Four classrooms were selected for detailed vignettes to illustrate consistently high quality instructional practices across Emotional Support, Classroom Organization, and Instructional Support CLASS PreK domains. In order to have been considered for a vignette, it was required that the classroom had scores in the top 10% for each of the three domains. In addition, only one classroom was selected from a region of the state to illustrate regional diversity in the presentation of best practices in prekindergarten instruction.

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[125] CLASS PreK scores for the Negative Climate dimension was reverse coded to be consistent with scores for the other nine dimensions.

# Appendix B: Literature Review Data Sources

This appendix shows sources and key data fields used in the literature review analysis (see Table B.1).

**Table B.1: Matrix of Publications for Literature Review and Key Data Fields**

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| Administration for Children and Families, Office of Child Care | 2007 | Head Start Act | Early Childhood Learning and Knowledge Center https://eclkc.ohs.acf.hhs.gov/hslc/standards/law | NA | NA | Nationwide | On December 12, 2007, former President George W. Bush signed Public Law 110-134 "Improving Head Start for School Readiness Act of 2007" reauthorizing the Head Start program. This law contains significant revisions to the previous Head Start Act and authorizes Head Start through September 30, 2012. |
| Administration for Children and Families, Office of Child Care | 2016 | CCDF Reauthorization | http://www.acf.hhs.gov/occ/ccdf-reauthorization | Federal guidelines | NA | NA | Reauthorization of the Child Care and development Block Grant requires states to Requires States to spend quality funds on at least 1 of 10 specified quality activities, which include developing tiered quality rating systems and supporting statewide resource and referral services. |
| Aguirre, E., Gleeson, T., McCutchen, A., Mendiola, L., Rich, K., Schroder, R., Stephenson, M., Varner, O., & Taylor, L. | 2006 | A Cost-Benefit Analysis of Universally Available Pre-Kindergarten in Texas | Texas A&M Bush School for Government and Public Service http://bush.tamu.edu/research/capstones/mpsa/projects/TECEC2006/ExecutiveSummary-ACost-BenefitAnalysisofHigh-QualityUniversally-AccessiblePre-KindergartenEducationInTexas.pdf | Cost-Benefit Analysis | NA | Texas | Findings: Every $1.00 invested in the proposed high-quality program returns $3.50 per participant, based on the enrollment of seventy percent of all four-year- olds in the state. Because it is more expensive to establish new classrooms than to upgrade existing classrooms, the return on investment decreases to $3.31 with ninety percent enrollment |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| American Academy of Pediatrics, American Public Health Association, National Resource Center for Health and Safety in Child Care and Early Education | 2011 | Caring for our Children National Health and Safety Performance Standards: Guidelines for Early Care and Education Programs (3rd ed.) | http://nrckids.org/ | Guidelines | NA | Nationwide | National guidelines |
| Andrews, R., Jargowsky, P., & Kuhne, K. | 2012 | The Effects of Texas's Targeted Pre-Kindergarten Program on Academic Performance | NBER Working Paper Series http://www.nber.org/papers/w18598 | Program Evaluation | 682, 749 children | Texas | The study found that having participated in Texas's targeted prekindergarten program is associated with increased scores on the math and reading sections of the Texas Assessment of Academic Skills (TAAS), reductions in the likelihood of being retained in grade, and reductions in the probability of receiving special education services. We also find that participating pre-K increases mathematics scores for students who take the Spanish version of the TAAS tests. While the effects are smaller than those reported for model programs and resource-intensive programs, they indicate that even a modest program can help to boost student achievement. |
| Ansari, A. & Lopez, M. | 2015 | Preparing Low-Income Latino Children for Kindergarten and beyond: How Children in Miami's Public | National Resource center on Hispanic Children and Families http://www.childtrends.org/wp-content/uploads/2015/0 | Comparative Analysis | 11,894 children | Florida | Programs were required to be staffed by certified teachers with a child-adult ratio of no more than 20:2. In general, Latino children from low-income families within the MSRP sample who attended |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | Preschool Program Fare | 9/Hispanic-Center-MSRP-Brief-FINAL.pdf | | | | either public school pre-K or center-based care fared well on assessments of kindergarten readiness, and continued to do well through the end of the third-grade year. |
| Barnett, S., Friedman-Krauss, A., Gomez, R., Horowitz, M., Weisenfeld, G., Brown, C., & Squires, J. | 2016 | The State of Preschool 2015: State Preschool Yearbook | National Institute of Early Education Research (NIEER) http://nieer.org/research/state-preschool-2015 | Research Brief | NA | Nationwide | Texas meets 2 benchmarks: Comprehensive Early Learning Standards and Teacher in-service training. Texas does not meet the recommended benchmarks for Class size and Student-to-Teacher ratio. |
| Barnett, W., Jung, K., Youn, M., & Frede, E. | 2013 | Abbott Preschool Program Longitudinal Effects Study: Fifth Grade Follow-Up | NIEER http://nieer.org/sites/nieer/files/APPLES%205th%20Grade.pdf | Regression Discontinuity | 1,038 children | New Jersey | The 4th and 5th grade APPLES follow-up finds that Abbott preschool programs increased achievement in Language Arts and Literacy, Math, and Science. The Abbott Preschool program also is found to decrease grade retention and special education placement rates. The Abbott Preschool program's effects on achievement and school success are larger than has been found for less well-funded programs with weaker standards. |
| Barnett, S., Schulman, K., & Shore, R. | 2004 | Class Size: What's the Best Fit? | NIEER http://nieer.org/resources/policybriefs/9.pdf | Literature Review | NA | NA | Class size reduction is a policy that can increase educational effectiveness. Small class size and better staff-child ratios offer health and safety benefits. Most state preschool programs and the federal Head Start program do not require the small class sizes |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | | | | | found to produce the large educational gains desired for disadvantaged students. Some state preschool programs set no limits on class size. Costs of class size reduction depend on the starting point, opportunities for more efficient allocation of staff, and the extent of cost-savings from lower administrative costs (from reduced turnover, for example). |
| Bartik, T. | 2014 | From Preschool to Prosperity The Economic Payoff to Early Childhood Education | W.E. Upjohn Institute for Employment Research http://www.upjohn.org/sites/default/files/WEfocus/FromPreschooltoProsperity.pdf | Literature Review | NA | NA | Many early childhood education programs have rigorous evidence for high benefit-cost ratios. We know something about what types of programs have the biggest bang for the buck, and how to improve program quality over time. Benefits of early childhood education are broad enough that taxpayer support is justified. Benefits of early childhood education are local enough to justify support by state and local governments. Early childhood education can play a significant role in an overall economic strategy to enhance U.S. economic growth and broaden economic opportunities. |
| Child Care Aware of America | 2013 | Mothers in the Workforce | Child Care Aware of America http://www.naccrra.net/sites/default/files/default_site_pages/2013/moth | Report | NA | NA | The last 30 years have shown a substantial increase in labor force participation by women with children. With working mothers making ever greater contributions |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | ers_in_the_workforce_april_2013.pdf | | | | to household incomes, access to child care has become an essential work support for families. |
| Committee on Integrating the Science of early Childhood Development | 2000 | From Neurons to Neighborhoods: The Science of Early Childhood Development | National Academy Press (book) | Literature review | NA | NA | The fundamental issues addressed by this report concern the relation between early life experiences and early development. Although there have been long-standing debates about how much the early years really matter in the larger scheme of lifelong development, the committee is unequivocal in its conclusion: what happens during the first months and years of life matters a lot. |
| Duncan, D. & Magnuson, K. | 2013 | Investing in Preschool Programs | Journal of Economic Perspectives https://www.aeaweb.org/articles?id=10.1257/jep.27.2.109 | Literature Review | NA | NA | Many early childhood education programs appear to boost cognitive ability and early school achievement in the short run. However, most of them show smaller impacts than those generated by the best-known programs, and their cognitive impacts largely disappear within a few years. |
| Duncan, G. Kalil, A., & Ziol-Guest, K. | 2013 | Early childhood poverty and adult achievement, employment and health. | Family Matters No. 93, 27-35. | | | | |
| Francis, J. | 2014 | Relating Preschool Class Size to Classroom Life and Student Achievement | Dissertations http://ecommons.luc.edu/luc_diss/894 | Randomized Control Trial (RCT) | 354 children, 21 teachers | Illinois | In general, results from the current study show that reducing class size does not inevitably increase classroom quality but it may increase the quantity of interactions in the classroom. |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|--------|------|-------|-------------------------|-----------------|-------------|------------------------|----------|
| | | | | | | | However, differences between class sizes were minimal and since there were significant and substantive effects of class size on children's learning, findings suggest that class size reduction affected children in some other way that was not measured by the CLASS or Snapshot. |
| Frede, E., Kwanghee J., Barnett, S., Lamy, C., & Figueras, A. | 2007 | The Abbott Preschool Program Longitudinal Effects Study Interim Report | NIEER http://nieer.org/resources/research/APPLES.pdf | Regression Discontinuity | 316 classrooms | New Jersey | The findings of this study provide clear evidence of the following: classroom quality in the Abbott Preschool Program continues, on the whole, to improve; children who attend the program, whether in public schools, private settings or Head Start, are improving in language, literacy, and math at least through the end of their kindergarten year; and children who attend preschool for two years at both age 3 and 4 significantly out-perform those who attend for only one year at 4 years of age or do not attend at all. |
| Gormley, W., Gayer, T., Phillips, D., & Dawson, B. | 2004 | The Effects of Oklahoma's Universal Pre-K Program on School Readiness: An Executive Summary. | Georgetown University Center for Research on Children in the U.S. | Program Evaluation | 1,567 pre-K students and 3,149 kindergarten students | Tulsa, Oklahoma | A 52 percent gain in the Letter-Word Identification test score; a 27 percent gain in the Spelling test score; and a 21 percent gain in the Applied Problems test score. That is the average change in each test score attributable to the Tulsa pre-K program. Class size was 20 and student-to-teacher ratio was 10:1 |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| Hart Research Associates | 2013 | Employers More Interested in Critical Thinking and Problem Solving Than College Major | Association of American Colleges and Universities https://www.aacu.org/sites/default/files/files/LEAP/2013_EmployerSurvey.pdf | Survey | NA | NA | This report provides a detailed analysis of employers' priorities for the kinds of learning today's college students need to succeed in today's economy. It also reports on changes in educational and assessment practices that employers recommend. |
| Heckman, J. | 2011 | The Economics of Inequality: The Value of Early Childhood Education | American Educator | Report | NA | NA | Taking a hard look at the economic value of efforts to create human capital helps people see where best to invest their resources in education to achieve its ideal--equalizing opportunity to build greater and enduring value for all. The evidence is quite clear that inequality in the development of human capabilities produces negative social and economic outcomes that can and should be prevented with investments in early childhood education, particularly targeted toward disadvantaged children and their families. |
| Heckman, J., Pinto, R., & Savelyev, P. | 2013 | Understanding the Mechanisms Through Which an Influential Early Childhood Program Boosted Adult Outcomes | The American Economic Review | Experimental Evaluation | NA | Michigan | This paper uses longitudinal data on cognitive and personality skills from an experimental evaluation of the influential Perry Preschool program to analyze the channels through which the program boosted both male and female participant outcomes. Experimentally induced changes in personality skills explain a |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | | | | | sizable portion of adult treatment effects. |
| Howes, C., Burchinal, M., Pianta, R., Bryant, D., Early, D., Clifford, R., & Barbarin, O. | 2008 | Ready to Learn? Children's Pre-Academic Achievement in Pre-Kindergarten Programs | Early Childhood Research Quarterly http://www.sciencedirect.com/science/article/pii/S088520060700035X | Prospective Evaluation | 2,800 children, 700 programs | 11 states | Enrollment in Pre-K appeared related to gains in academic skills. Children showed larger gains in academic outcomes when they experienced higher-quality instruction or closer teacher–child relationships. Gains were not related to characteristics of the child or program (i.e., ratio, teacher qualifications and program location and length). |
| Hustedt, J., Barnett, S., Kwanghee, J., & Figueras, A. | 2009 | Continued Impacts of New Mexico Pre-K on Children's Readiness for Kindergarten | NIEER http://nieer.org/pdf/NewMexicoRDD0909.pdf | Regression Discontinuity | 1,333 children | New Mexico | Children who attended New Mexico PreK during the 2007-2008 school year scored higher on assessments of early math and literacy skills in comparison to children who did not attend. Gains in early math and literacy at kindergarten entry can be attributed to participating in New Mexico PreK programs the previous year. New Mexico PreK classrooms have maximum class sizes of 20 with staff-child ratios of 1:10. |
| Karoly, L. & Auger, A. | 2016 | Informing Investments in Preschool Quality and Access in Cincinnati | RAND Corporation http://www.rand.org/t/rr1461 | Literature Review | 15 programs | 13 states | Researchers have inferred which program features appear to be consistently present in successful programs or those that are strongly predictive of children's developmental gains based on naturally occurring variation in program features. Research also suggests a role for a set of |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | | | | | structural quality features that provide the conditions that support the realization of high process quality. These structural features include those often measured or regulated: the group size, staff-child ratio, teacher qualification, and curriculum. |
| La Paro, K. M., Thomason, A. C., Lower, J. K., Kitner-Duffy, V. L., & Cassidy, D. J. | 2012 | Examining the Definition and Measurement of Quality in Early Childhood Education: A Review of Studies Using the ECERS-R from 2003 to 2010 | Early Childhood Research & Practice, 14(1) | Literature Review | NA | Nationwide | Provides further support for the importance of high-quality early childhood education on children's brain development |
| Layzer, J. & Goodson, B. | 2006 | The "Quality" of Early Care and Education Settings: Definitional and Measurement Issues. | Evaluation Review, 20(5), 556-576 | | | | |
| Lipsey, M. W., Farran, D. C., Bilbrey, C., Hofer, K. G., & Dong, N. | 2011 | Initial Results of the Evaluation of the Tennessee Voluntary Pre-K Program | Peabody Research Institute, Vanderbilt University | Program Evaluation | | | 5 year study in their second year. 342 age-eligible children in the 23 schools whose randomized lists included both admitted children and children not admitted by the beginning of the school year. The effects on the early literacy, language, and math skills of children who attended TN-VPK were all statistically significant with gains ranging from 37% to 176% greater than those of children not in TN-VPK. Adult-student ratio of no less than 1:10, a maximum class size of 20. |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| Mashburn, A. J., & Pianta, R. C. | 2010 | Opportunity in Early Education: Improving Teacher-Child Interactions | University of Virginia, Center for Advanced Study of Teaching and Learning | | | | |
| Mashburn A., Pianta R., Hamre B., Downer J., Barbarin O., Bryant D., Burchinal M., Early D., & Howes C. | 2008 | Measures of Classroom Quality in Prekindergarten and Children's Development of Academic, Language, and Social Skills | Child Development http://www.ncbi.nlm.nih.gov/pubmed/18489424 | Complex Modeling | 2,439 children, 671 classrooms | 11 states | Adjusting for prior skill levels, child and family characteristics, program characteristics, and state, teachers' instructional interactions predicted academic and language skills and teachers' emotional interactions predicted teacher-reported social skills. Findings suggest that policies, program development, and professional development efforts that improve teacher-child interactions can facilitate children's school readiness. |
| Mashburn, A., Hamre, B., Downer, J., & Pianta, R. | 2006 | Teacher and Classroom Characteristics Associated with Teachers' Ratings of Prekindergartners' Relationships and Behaviors | Journal of Psychoeducational Assessment http://jpa.sagepub.com/content/24/4/367.abstract | Simple Correlational | 711 children, 210 teachers | 6 states | Teachers' ratings of positive relationships and behaviors were associated with fewer years of experience, higher self-efficacy, non-White race/ethnicity, shorter length programs, better child-teacher ratios, and programs located within school settings. |
| Minervino, J. | 2014 | The Essential Elements of High-Quality Pre-K: An Analysis of Four Exemplar Programs | Gates Foundation https://docs.gatesfoundation.org/documents/Lessons%20from%20Research%20and%20the%20Classroom_September%202014.pdf#page=23 | Research Brief | NA | 4 states | All exemplar programs have maximum class size of 22 children or fewer and adult-to-child ratios ranging from 15:2 to 22:2. Student-to-teacher ratios at the lower end of the range are particularly advantageous for classrooms where a significant number of English language |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | | | | | learners (ELLs) are present and/or where a significant number of children with special needs are present. |
| National Accreditation Commission for Early Care and Education Programs | 2005 | (2005). National Accreditation Commission Guidelines | http://www.earlylearningleaders.org/?page=accreditation | National Guidelines | NA | Nationwide | National Accreditation Guidelines |
| National Association for the Education of Young Children | 2016 | NAEYC Early Childhood Program Standards and Accreditation Criteria & Guidance for Assessment. | http://www.naeyc.org/accreditation/ | National Guidelines | NA | Nationwide | National Accreditation Guidelines |
| National Center for Education Statistics | 2016 | The Condition of Education 2016 at a Glance. | http://nces.ed.gov/pubs2016/2016144_ataglance.pdf | quantitative | NA | Nationwide | |
| National Research Council Committee on Early Childhood Pedagogy | 2001 | Eager to Learn: Educating our Preschoolers | National Academies Press http://www.nap.edu/catalog/9745/eager-to-learn-educating-our-preschoolers | Literature Review | NA | NA | Both class size and adult-child ratio are correlated with greater program effects. Low adult-child ratios are associated with more extensive teacher-child interactions, more individualization, and less restrictive and controlling teacher behavior. Smaller group size has been associated with more child initiations and more opportunities for teachers to work on extending language, mediating children's social interactions, and encouraging and supporting exploration and problem solving. |
| Peisner-Feinberg, E. & Schaaf, J., | 2015 | Children's kindergarten outcomes and program quality in the North | Frank Porter Graham Child Development | RDD | 561 children in year 1 (pre-k) and 437 children | North Carolina | Children enrolled in the NC Pre-K Program made significant gains over this time period across all |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| Hildebrandt, L., Pan, Y., & Warnaar, B. | | Carolina Pre-Kindergarten Program | Institute, The University of North Carolina | | in year 2 (kindergarten) | | domains of learning. Children showed significant growth in language and literacy skills (receptive vocabulary, expressive vocabulary, letter-word identification, phonological awareness), math skills (math problem-solving, counting), general knowledge (basic self-knowledge), and behavior skills (social skills). Class sizes are restricted to 18 children with a lead and assistant teacher, with adult-to-child ratios of 1:9. |
| Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., & Barbarin, O. | 2005 | Features of Pre-Kindergarten Programs, Classrooms, and Teachers: Do They Predict Observed Classroom Quality and Child-Teacher Interactions | Applied Developmental Science | | Pianta, R., Howes, C., Burchinal, M., Bryant, D., Clifford, R., Barbarin, O. | NA | Features of Pre-Kindergarten Programs, Classrooms, and Teachers: Do They Predict Observed Classroom Quality and Child-Teacher Interactions? |
| Puma, M., Bell, S., Cook, R., Heid, C., Shapiro, G., Broene, P., Jenkins, F., Fletcher, P., Quinn, L., Friedman, J., Ciarico, J., Rohacek, M., Adams, G., & Spier, E. | 2010 | Head Start Impact Study Final Report | Administration for Children and Families https://www.acf.hhs.gov/sites/default/files/opre/hs_impact_study_final.pdf | Randomized Control Trial (RCT) | 4,667 children, 383 Head Start centers | 23 states | Providing access to Head Start has a positive impact on children's preschool experiences. There are statistically significant differences between the Head Start group and the control group on every measure of children's preschool experiences measured in this study. Access to Head Start has positive impacts on several aspects of children's school readiness during their time in the program. However, the |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | | | | | advantages children gained during their Head Start and age 4 years yielded only a few statistically significant differences in outcomes at the end of 1st grade for the sample as a whole. |
| Quality Rating and Improvement System National Learning Network | 2016 | Quality Rating and Improvement Systems Framework | Quality Rating and Improvement System National Learning Network http://qrisnetwork.org/our-framework | Report | NA | All States | A QRIS is not just about ratings or a stand-alone program to improve quality, it is a unique tool for system reform that has the potential to reach programs that serve a wide range of children and are financed by many public and private sources, including parent fees. |
| Region Track, Inc. | 2016 | Child Care in State Economies | Committee for Economic Development https://www.ced.org/childcareimpact | Report | NA | All States | Child Care in State Economies examines the child care industry's effect on parents' participation in the labor force, and provides extensive details regarding the industry's state economic impact, including: usage rates, the role of public funding, revenues, and business structure. |
| Schaaf, J., Peisner-Feinberg, E., LaForett, D., Hildebrandt, L., & Sideris, J. | 2014 | Effects of Georgia's Pre-K Program on Children's School Readiness | Frank Porter Graham Child Development Institute, The University of North Carolina | Program Evaluation | 1181 children | Georgia | Sample included a total of 1,181 children—611 children in the treated group (children who had completed Georgia's Pre-K Program the previous year and were entering kindergarten in the study year) and 570 children in the untreated group (children who were ineligible for Georgia's Pre-K Program the previous year and were entering pre-k in the study year |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|--------|------|-------|------------------------|-----------------|-------------|------------------------|----------|
| | | | | | | | Assessments included the area of language, literacy, math, and general knowledge skills and teacher ratings of behavior skills. Class sizes are limited to 20–22 children with a lead and assistant teacher, with adult: child ratios of 1:11. |
| Schindlera, H., Kholoptsevab J., Soojin S., Oh, S., Yoshikawac, H., Duncand, G., Magnusone, K., & Shonkoff, J. | 2015 | Maximizing the potential of early childhood education to prevent externalizing behavior problems: A meta-analysis | Journal of School Psychology | Meta-Analysis | 31 Programs | Nationwide | Prekindergarten students demonstrated decreased externalizing behaviors (e.g., aggressive, antisocial, and rule-breaking behaviors). |
| Institute of Medicine | 2000 | From Neurons to Neighborhoods | National Academies Press | Literature Review | NA | Nationwide | Provided the framework for studying the relationship between early childhood educational research and brain development. |
| State of Texas: Office of the Governor | 2015 | Press Release State Budget. | http://gov.texas.gov/news/press-release/20543 | Press Release | NA | Texas | Press release of state budget with prekindergarten as emergency item. |
| Temple, J., Reynolds, A., | 2007 | Benefits and costs of investments in preschool education: Evidence from the Child–Parent Centers and related programs. | The Economics of Early Childhood Education 26(1), pp. 126-144 | Cost Benefit Analysis | 1400 | Illinois | The evidence suggests that economic returns of high-quality prekindergarten programs exceed most other educational interventions, especially those that begin during the school-age years, such as reduced class sizes in the elementary grades, grade retention, and youth job training |
| Texas Department of Family and Protective Services. | 2015 | Child Care Licensing Minimum Standards for Child Care Centers. | Retrieved July 18, 2016, from Child Care Licensing: http://www.dfps.sta | Standards | NA | Texas | Minimum Standards for center-based programs in Texas. |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| | | | te.tx.us/Child_Care /default.asp | | | | |
| Texas Early Learning Council | 2011 | Texas Early Learning Council Definition of School Readiness | Texas Early Learning Council http://www.earlylearning texas.org/school-readiness.aspx | NA | NA | Texas | To arrive at this definition, the Council researched definitions of school readiness adopted by other states. Read an analysis of definitions of school readiness that was used to guide the Council's definition, as well as resources from other states. |
| Texas Education Agency | 2015 | Texas Prekindergarten Guidelines | Texas Education Agency http://tea.texas.gov/inde x2.aspx?id=214749550 8 | NA | NA | Texas | The revised prekindergarten guidelines are aligned with the Kindergarten Texas Essential Knowledge and Skills (TEKS), sequenced to follow child development and give teaching strategies for each of the guidelines. The new guidelines offer educators the information and support to prepare all children for success in Kindergarten. |
| Texas Education Agency | 2016a | Enrollment in Texas Public School 2014-2015 | Texas Education Agency http://tea.texas.gov/acct res/enroll_index.html | Report | NA | Texas | This report provides information on enrollment in the Texas public school system from the 2004–05 through 2014–15 school years, based on data collected through the Texas Public Education Information Management System. Enrollment data are provided by grade, race/ethnicity, gender, and economically disadvantaged status, and for special populations and instructional programs. |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| Texas Education Code | 1999 | Texas Education Code | Texas School Law Bulletin. Minnesota, St. Paul: West group | | | | |
| Texas Workforce Commission | 2015 | Texas Rising Star | Texas Rising Star https://texasrisingstar.org/about-trs/history-of-trs/ | Website | NA | Texas | Provides historical context of how the designated vendor program, now known as Texas Rising Star, began in Texas. Provides guidelines for class size and student-to-teacher ratio. |
| United Federation of Teachers | 2010 | Frequently Asked Questions (Website) | http://www.uft.org/faqs?category=479&orderBy=posted | National Guidelines | NA | National | National Guidelines for public prekindergarten |
| Wechsler, M., Melnick, H., Maier, A., & Bishop, J. | 2016 | The Building Blocks of High-Quality Early Childhood Education Programs | Learning Policy Institute https://learningpolicyinstitute.org/wp-content/uploads/2016/02/LPI_ECE-quality-brief_WEB-022916.pdf | Literature Review | NA | NA | The most successful preschool programs have small class sizes and low teacher-student ratios. Having fewer students in a classroom and more staff facilitates high-quality interactions between teachers and children. Although there is little research on the optimal number, a class size of 20 with a student-to-teacher ratio of 10:1 is the largest acceptable by general professional standards. |
| Wong, V., Cook, T., Barnett, S., & Jung, K. | 2008 | An Effectiveness-Based Evaluation of Five State Pre-Kindergarten Programs | Journal of Policy Analysis and Management http://onlinelibrary.wiley.com/doi/10.1002/pam.20310/epdf | Regression Discontinuity | 5,278 children | 5 states | "The sample of states differed in many other ways, permitting the conclusion that state pre-K programs can have positive effects on children's cognitive skills, though the magnitude of these effects varies by state and outcome." |
| Yoshikawa, H., Weiland, C., Brooks-Gunn, J., Burchinal, | 2013 | Investing in Our Future: The Evidence Base on Preschool Education | Foundation for Child Development | Meta-Analysis | NA | NA | The evidence continues to grow that the foundation for positive effects on children are |

| Author | Year | Title | Journal or Web Location | Research Design | Sample Size | Study Location (State) | Overview |
|---|---|---|---|---|---|---|---|
| M., Espinosa, L., Gormley, W., Ludwig, J., Magnuson, K., & Zaslow, M. | | | http://fcd-us.org/sites/default/files/Evidence%20Base%20on%20Preschool%20Education%20FINAL.pdf | | | | interactions with teachers that combine stimulation and support. Features of quality that focus on structural elements, such as group size, ratio, and teacher qualifications are important in that they help to increase the likelihood of such interactions, but they do not ensure that simulating and supportive interactions will occur. |

# Appendix C: Technical Information about Results from the Study

## Prekindergarten Classroom Observation Data

Table C.1 shows the final sites and dates of completed observations. Characteristics and demographic data of the selected sites are provided in in the Descriptive Profiles of Campuses Included in Prekindergarten Observations section in Chapter 2.

**Table C.1: Districts and Number of Observed Classrooms, May 2016**

| Location and Date of Observation | Number of Observations Conducted |
|---|---|
| **Central Texas** | **29** |
| **Austin ISD** | **10** |
| Gullett, 5/25/2016 | 2 |
| Hill, 5/4/2016 | 2 |
| Maplewood, 5/4/2016 | 2 |
| Pillow, 5/16/2016 | 4 |
| **Jubilee Academy Center** | **2** |
| Wells Branch Leadership Academy, 5/5/2016 | 2 |
| **Killeen ISD** | **17** |
| Oveta Culp Hobby | 9 |
| 5/3/2016 (7 Observations) | |
| 5/4/2016 (2 Observations) | |
| Venable Village | 8 |
| 5/5/2016 (5 Observations) | |
| 5/6/2016 (3 Observations) | |
| **Dallas Metro** | **14** |
| **Arlington ISD** | **5** |
| Bebensee, 5/16/2016 | 2 |
| Hale, 5/16/2016 | 2 |
| Miller, 5/16/2016 | 1 |
| **Crowley ISD** | **6** |
| Oakmont, 5/18/2016 | 2 |
| Parkway, 5/20/2016 | 2 |
| Sycamore, 5/17/2016 | 2 |
| **Mesquite ISD** | **3** |
| Hodges, 5/19/2016 | 2 |
| Seabourn, 5/19/2016 | 1 |
| **Houston/Gulf Coast** | **28** |
| **Aldine ISD** | **24** |
| Jones EC/PRE-K/KG Center | 15 |
| 5/18/2016 (8 Observations) | |
| 5/19/2016 (7 Observations) | |
| Reece Academy | 9 |
| 5/16/2016 (5 Observations) | |
| 5/17/2016 (4 Observations) | |
| **Klein ISD** | **4** |
| Blackshear, 5/20/2016 | 1 |
| Kreinhop, 5/20/2016 | 2 |
| Northampton, 5/20/2016 | 1 |

**Table C.1: Districts and Number of Observed Classrooms, May 2016 (continued)**

| Location and Date of Observation | Number of Observations Conducted |
|---|---|
| **San Antonio** | **6** |
| **Jubilee Academic Center** | **1** |
| Highland Park Gifted and Talented, 5/23/2016 | 1 |
| **Knippa** | **2** |
| Knippa School, 5/4/2016 | 2 |
| **San Antonio ISD** | **3** |
| Highland Park, 5/5/2016 | 3 |
| **South Texas/Rio Grande Valley** | **15** |
| **Brownsville ISD** | **7** |
| Champion, 5/26/2016 | 3 |
| Gallegos, 5/27/2016 | 1 |
| Villa Nueva, 5/25/2016 | 3 |
| **Hidalgo ISD** | **6** |
| Dr Alejo Salinas Jr | 4 |
| 5/23/2016 (3 Observations | |
| 5/24/2016 (1 Observation) | |
| Hidalgo, 5/23/2016 | 2 |
| **McAllen ISD** | **2** |
| Jackson, 5/24/2016 | 2 |
| **West Texas** | **5** |
| **Cotton Center ISD** | **1** |
| Cotton Center School, 5/24/2016 | 1 |
| **Post ISD** | **3** |
| Post, 5/25/2016 | 3 |
| **Sweetwater ISD** | **1** |
| Southeast, 5/25/2016 | 1 |
| **Grand Total** | **97** |

Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016

## Scatterplots Illustrating Relationship between Student-to-Teacher Ratio and Class Size to Quality Ratings

**Figure C.1: Scatterplots of the Relationship between Student-to-Teacher Ratio, the Number of Students, and CLASS PreK Scores for Observed Classrooms**
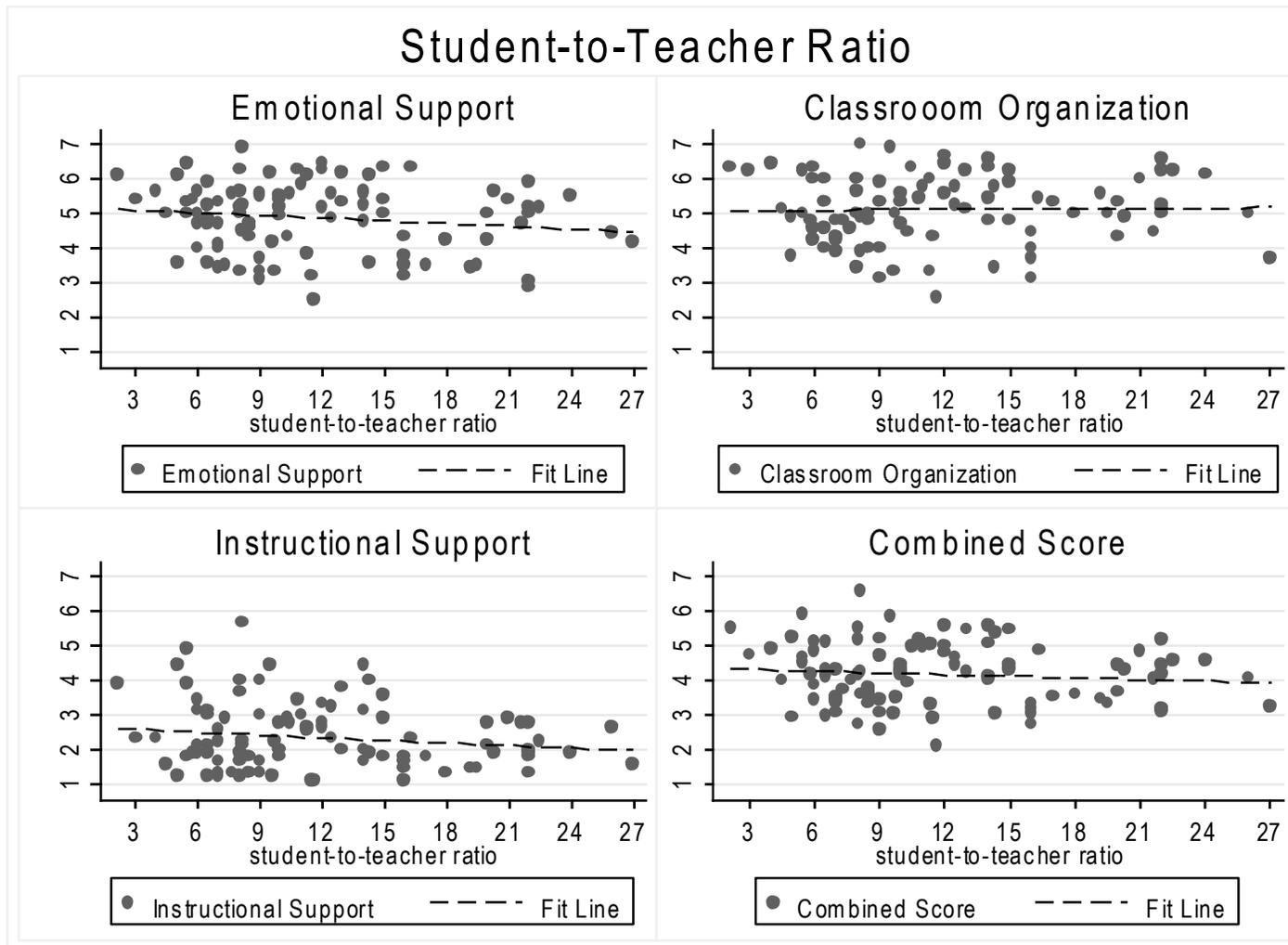


Source: CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations

**Figure C.2: Scatterplots of the Relationship between Class Size and CLASS PreK Domain-Level and Overall Observation Scores**
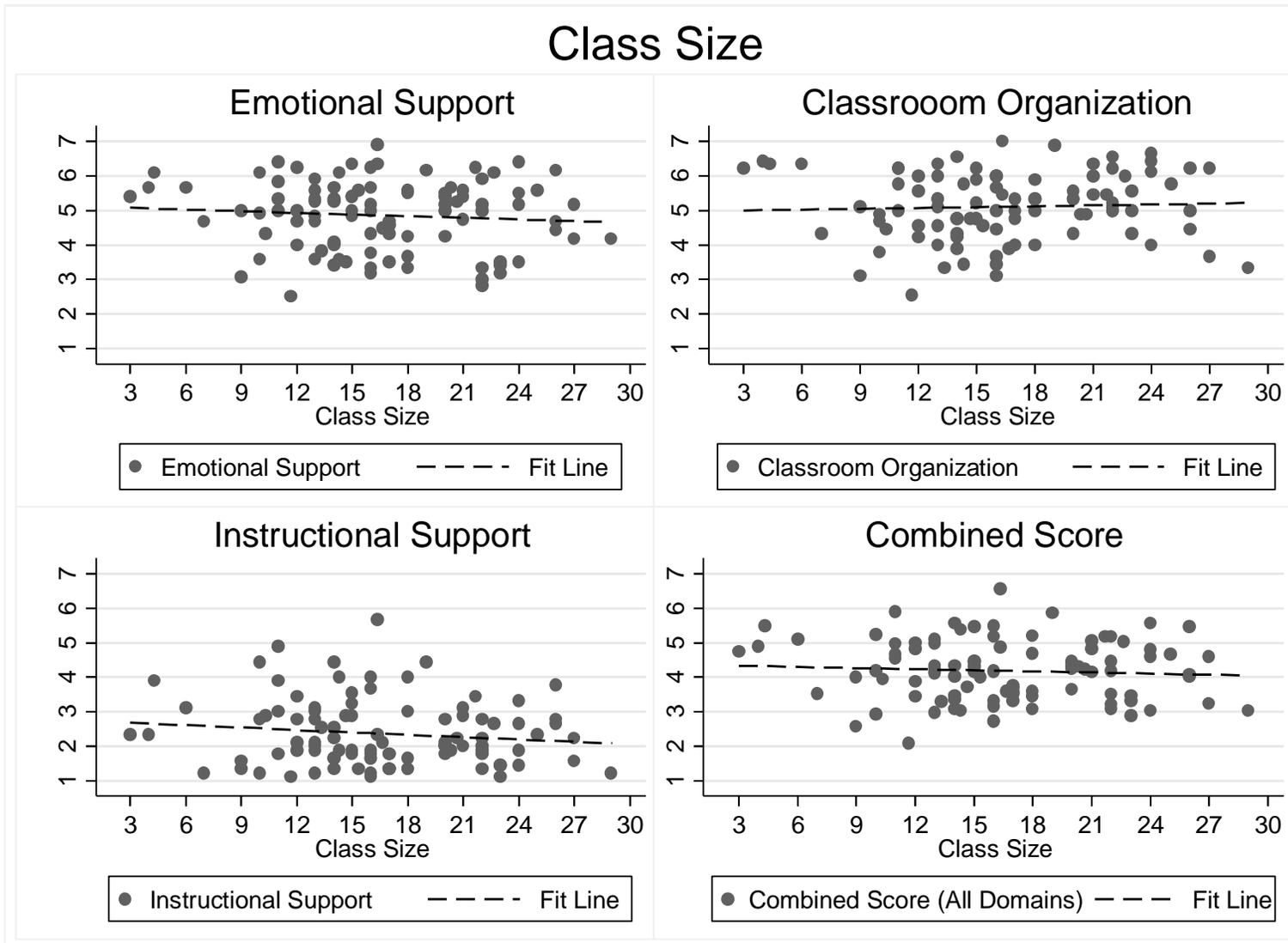


Source:   CLASS PreK scores derived from observations of Texas public prekindergarten classrooms, May 2016
Note: Results are based on 97 classroom observations.

# Appendix D: Four Vignettes Demonstrating Quality Instructional Practices from Observed in Public Prekindergarten Classrooms

To further describe the best prekindergarten instructional practices observed in Texas schools, the study team selected four classrooms with consistently high CLASS PreK ratings across the three domains (Emotional Support, Classroom Organization, and Instructional Support) to create vignettes that describe promising instructional practices in greater depth.

The four vignettes presented in this Appendix are the coded observational field notes for classrooms that received high scores on the CLASS PreK protocol from four different regions and four different observers. These classrooms were scored either in the top 10% overall or the top 10% for at least one of the three domains (i.e., Emotional Support, Classroom Organization, and Instructional Support). The observed student-to-teacher ratios for these classrooms ranged from 6:1 to 14:1.

## Vignette 1: Observed Best Practices: Central Texas Region

- Observed the week of May 2, 2016
- Student-to-teacher ratio in the classroom was 6:1
- Scored in the top 10% of all observed teachers
- Scored high range for Emotional Support, high range for Classroom Organization, and midrange for Instructional Support (top 10% for Emotional Support and Instructional Support domains)
- Observed during whole group instruction time covering music/movement time

*This teacher and children laughed, and the teacher made eye contact with the children. Children showed that they were comfortable with the teacher by asking her questions and a couple of children hugged her. Children were happily engaged in learning centers. There was much laughter and [many] smiles observed. The teacher sat on the floor helping children build with waffle blocks. Children were happily engaged in the centers and occasionally one child would seek out the teacher to ask her a question. She would touch their shoulder and get on their level when answering.*

*The teacher was aware when children had questions and took time to answer all their questions. Children exhibited warm fondness of teacher by asking her questions and giving her hugs. The teacher addressed children who are asking for additional help or who had questions. The teacher walked about the room, stopping to interact with groups of children. She noticed a child having trouble, she immediately went to address the issue. Children appeared very comfortable and actively engaged in learning.*

*Children freely asked questions and talked among each other. Children were allowed to move freely to the music. Children were allowed to choose which center they would like to go first. There were many choices of activities to choose from. Children could use the materials to build what they would like.*

*No behavior issues were observed. Children listened to the teacher and followed directions. Children were actively engaged in small group activities and no behavior issues were observed. The teacher reminded children to be careful when using the tools.*

*Children moved to a different center of their choice when prompted to do so. All centers were well stocked and set up for children to be able to independently get materials. The teacher used a buzzer to note a transition. Children appeared to know what to do next without prompting from the teacher.*

*The teacher was dancing with the children and used video, musical instruments, and other materials. Children were very interested in the activity. The teacher moved about the room, and got down on the floor and helped some*

*groups of children. There were many materials for the children to choose from in each learning center. Before sending the children to the centers, the teacher explained materials in each center and what they could do with the materials. The teacher actively engaged with small groups of children. She rotated throughout the room, interacting with small groups. All materials were available and at the child's reach. Children were actively engaged in activities in each center, primarily focused on building things.*

*The teacher effectively used how and why questions to allow the children to critically think and problem solve, such as "Why do you think that…" or "Why does a question mark go at the end of a sentence?" The teacher integrated previous learning by starting a conversation with the children with "Remember yesterday when we talked about..." The teacher used a construction theme and talked about the construction going on around the school to explain what construction workers do. This theme was present throughout the learning centers. The teacher asked many questions to get children to think, such as "Why do we need to wear goggles?" or "How are we going to make the base of the building?" The teacher asked children to tell her their ideas. They engaged in a group discussion about what they are going to build. The teacher asked: "Are you going to build a big house or a little house?" The teacher made a comment about one child's block design, "It looks like the Pentagon Building, in Washington, D.C.?" She got a book with a picture of the Pentagon to show the child.*

*The teacher asked many questions to prompt their thinking, such as "What are we learning?" and "What part of the body does this protect?" and then she would follow up with discussion. The teacher talked about the materials in the centers such as goggles and safety vests. There were several feedback loops heard between teacher and children on their activities around construction. The teacher used effective questioning, such as "Are you big or small?" and "What do you think we can use?" Several feedback loops were heard about the pattern of the blocks. The teacher used scaffolding to help children with words. The teacher provided very rich information about the materials used to build buildings.*

*There were many conversations going on in all the learning centers around the projects they were working on as a team. The teacher facilitated these conversations by asking students open-ended questions. The teacher used several opportunities to use self- and parallel-talk when explaining things to children. Many conversations were observed, between teacher and children and children with children.*

## Vignette 2: Observed Best Practices: San Antonio Region

- Observed the week of May 2, 2016
- Student-to-teacher ratio in the classroom was 9:1
- Scored midrange for Emotional Support, Classroom Organization, and Instructional Support (top 10% for Instructional Support domain)
- Observed during whole group instruction time and center time covering literature/language arts content and centers

*This teacher gave consistent positive communication and affection: high fives, "Kiss your brain," "Let's give our brains a round of applause." There was consistent respectful language (e.g., lots of "please" and "thank you," referring to children as "friend"), and the teacher's voice was always polite/calm/warm. Children helped each other at centers, and both adults communicated positive expectations for children ("Let's see if you can do it!").*

*Activities were prepared and provided the whole time with good pacing and no disruptions. There were learning opportunities through songs during transition from circle to centers, and efficient and quick transitions between centers.*

*The teacher and educational aide actively facilitated some activities (i.e., all of circle time and some of the centers), and there were a variety of hands-on materials at the centers (paint, puzzles, building blocks, computers, etc.).*

*Students were all actively participating, but learning objectives were not clear for all the centers (e.g., children played with the animals at the building center even after the teacher tried orienting them to building their own Leaning Tower of Pisa).*

*The teacher related some concepts to children's lives (e.g., during story time the teacher said: "How do you feel when mom hugs you?"). The teacher asked some analytical/prediction questions (e.g., at the building center, teacher asked, "Do you think it will fall? How many will it take for it to lean? How many for it to fall?"). However, children did not get to be creative (centers were teacher-driven activities and products, e.g. Leaning Tower of Pisa and making a Mother's Day Card), and concepts were not integrated.*

*The teacher and aide provided often/consistent scaffolding (e.g., helping children think of what plants need to grow) and assistance (e.g., while working on a puzzle or working on a pattern, the aide said: "What comes after one?" "Let's go look for it over there"). There were some follow-up questions observed (e.g., "What else does a plant need to grow?"), and recognition/affirmation that encouraged participation (e.g., "I love how you're blending your letters to make a word—kiss your brain, good job!").*

*The teacher used some variety/advanced language with children (e.g., "characters" and "pollen"). Both the teacher and educational aide used some self- and parallel-talk during centers (e.g., the aide while with children at the plant station, the teacher while helping at the play dough station). There were occasional back/forth between teacher/aide and children.*

## Vignette 3: Observed Best Practices: Houston/Gulf Coast

- Observed the week of May 16, 2016
- Student-to-teacher ratio in the classroom was 14:1
- Scored midrange for Emotional Support, high for Classroom Organization, and midrange for Instructional Support (top 10% for Classroom Organization domain)
- Observed during whole group instruction time covering science and literature/language arts content
- Bilingual classroom

*This teacher appeared to have a good relationship with students (e.g., sat on carpet with them during science lesson, mostly in close proximity during centers and testing). Lots of positive affect, especially during science lesson (e.g., smiling from teacher and students, enthusiasm). Respectful language and voice (e.g., warm, eye contact, students willing to help clean up).*

*Clear expectations (e.g., sitting on bottom during science lesson). Low reactivity (e.g., teacher held up one then two fingers to students to quiet down while continuing the activity, and they followed that subtle cue—the teacher had to do this very few times). Occasionally the teacher gave a stern look or simple said the child's name, but students were very well-behaved.*

*Students were always busy either in science lesson or center. Students knew what to do and quickly moved from center to center when it was time to switch for a smooth, quick transition. Materials were always prepared: teacher set out flags for practicing songs before center time was done, all materials prepped for centers.*

*This best practice was clearly carried by the first portion of the observation, but it was a great example of concept development. The teacher led the lesson on conservation and differences between fresh/salt water, animals that live in each, what happens when we pollute water. The teacher asked many why and how questions, allowing students time to answer and predict what would happen (e.g., "Why don't we drink salt water like whales? What would happen if we did?" "Why do you think it is called 'agua dulce' (fresh water)?"). The teacher integrated discussion into previous*

lesson about recycling and connected it to student behaviors (Teacher: "What would I do with this lid? Where would I recycle it?"

The teacher asked many questions to get students to the right answers and to prompt thought processes about pollution and conservation and its impact (Teacher: "I've finished using my toothpick and I toss it in the water when I'm done." Student: "NO!" Teacher: "Wait, what? Why not?"). The teacher gave minimal encouragement or reinforcement (a simple nod of the head or occasional smile). The teacher provided information on differences between fresh/salt water and where we find different types. Many feedback loops with whole class rather than individual students were observed.

The teacher asked many open-ended questions about fresh/salt water and pollution, some closed-ended questions. Frequent back and forth between students and teacher in whole group were observed—some in centers, but less so. Peer conversation observed in centers. Teacher used advanced language in explanation of conservation, fresh water, salt water; also used self-talk and repetition/extension in science lesson (Teacher: "What lives in fresh water?" Student: "Whales!" Teacher: "Whales! Do whales live in rivers?" Student: "No!" Teacher: "No! Whales are too big for rivers!").

## Vignette 4: Observed Best Practices: South Texas/Rio Grande Valley

- Observed the week of May 23, 2016
- Student-to-teacher ratio in the classroom was 8:1
- Scored in the top 10% of all observed teachers
- Scored high range for Emotional Support, high range for Classroom Organization, and midrange for Instructional Support (top 10% for all three domains)
- Observed during whole group instruction time covering literature/language arts and mathematics content areas

This teacher created a remarkably positive environment through encouraging and supportive feedback, smiling and laughing, and dialogue with students continuously throughout lessons. She consistently reinforced positive expectations, illustrating great respect between students and between the teachers and students. When the teacher's marker started running out of ink, one student responded, "Miss, your marker is done, I can buy you more."

The teacher was very aware of student needs and made a conscious effort to keep all students involved in group activities. Students were extremely comfortable answering questions and participating in activities in whole group and small group settings. This was evidenced by the number of student responses to questions and unsolicited dialogue between teacher and students.

The teacher regularly followed students' lead on comments, even when they were only tangentially related to lesson, and she acknowledged the value of a student's input, asking one or two follow-up comments or questions. Students were given responsibility and leadership opportunities to come to the front of the class and answer questions and write on white board (as teacher was modeling what the small group sessions would involve). Teachers constantly encouraged student talk from the student being asked questions and of other students adding onto the initial student's answer. Activities involved student movement (e.g., moving around mat to find numbers, writing on white board, etc.).

The teacher went over classroom rules (e.g., walk, listen, clean up, take care of school, and keep hands, feet, and mouth to yourself) and engaged the class in a discussion Q&A about why each rule was important and why they are in place. The teacher always used a calm tone to redirect students and regularly used positive comments to reinforce good behavior (e.g., "I like the way you are sitting on your bottoms," "Let's see who is sitting beautifully – [Child A] and [Child B], very nice"). Students were very well behaved throughout the lessons.

*The class really did run like a well-oiled machine with little or no disruptions that deterred from the learning process. Instructions were crystal clear about the activities and expectations and student obviously knew what to do (as evidenced by the teacher starting to give instructions and students finishing her sentence). The teacher had all materials at small group tables ready and the transition from whole group to small group was seamless.*

*At all times, the teacher actively facilitated student involvement through open-ended questioning that led to extended feedback loops and multiple students participating in discussion. In the whole group session, the teacher used multiple modalities (e.g., the white board, charts on the front board, and the carpet with numbers on it) but was especially effective at using the Q&A modality and utilizing various excited intonation of her voice to keep students engaged. Student interest in learning was high at all times (as evidenced by all eyes on the teacher, listening, and responding to questions). The teacher regularly used advanced organizers discussing what they were going to do, then modeling it, then providing questions to students make sure they understood what they were doing and why.*

*The teacher used the classroom rules as an opportunity to use analysis and reasoning skills by asking things like: "Why is it important that we listen? Why do we need to clean up our classroom?" She asked questions in the calendaring session which prompted student predictions and analysis. Teacher: "What kind of day is it?" Student: "Cloudy" Teacher: "So what might happen?" Student: "Rain" Teacher: "So it might rain, but we are not sure?" Student: "But we think it will." The teacher sometimes was able to link concepts and asked students to go back to things they learned in previous lessons.*

*The teacher was masterful at scaffolding with students from simply helping to sound out letter sounds and words, to more sophisticated scaffolding like using sky, grass, and the middle to refer to where top and bottom of letters should be when writing then on a line. She referred to certain letters as special and go "under the dirt" such as lower case "p." She engaged students in regular feedback loops involving multiple students, effectively prompted students through processes by responding to a student's comment with another comment or question. She consistently expanded student responses with additional information. Encouragement and affirmation were regularly provided by teacher and educational aide (e.g., "Oh, that is beautiful, keep up the good work;" "You are all so smart").*

*Frequent back and forth exchanges were observed with teacher building upon student responses (e.g., Teacher: "What letter is this?" Student: "C" Teacher: "What sound does it make?" Student: "c" Teacher: "What animal name starts with a C?" Student: "Cat" Teacher: "How does he move?" Student: "With his legs"). Teacher used multiple content areas to engage students in conversation. Open-ended questions were regularly utilized to help develop analytic and verbal skills. To a student response, the teacher almost always repeated it and extended the response with additional information or a question. Advanced language was also introduced (e.g., Teacher: "I am going to model this activity for you. Do you know what model means?" Student: "To show us how").*

# Appendix E: Promising Practices Observed in Public Prekindergarten Classrooms

This Appendix includes findings from the observations of public prekindergarten programs in spring 2016, specifically within the CLASS PreK Emotional Support and Classroom Organization domains. Within each domain dimension, the study team examined observation notes for the highest rated classrooms.

## Emotional Support Domain

### Positive Climate Dimension

**Best Practices Observed.** Among the classrooms that scored the highest for Positive Climate (i.e., top 10%), all four indicators of this dimension were observed: Positive Affect, Positive Communication, Relationships, and Respect.

**Table E.1: Promising Practice Examples for the Positive Climate Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Positive Affect**, is marked by smiling, laughter, and/or enthusiasm. | Frequent smiling and laughter among teachers and students were the most commonly noted behavioral markers for these 16 teachers, with enthusiasm being noted as well. |
| **Positive Communication** is defined in CLASS PreK as verbal affection, physical affection, and/or positive expectations. | For these 16 teachers, observers specifically noted physical affection (e.g., hugs, pats on the shoulder or head) and verbal affection (e.g., compliments from the teacher to students, students saying "I love you" to the teacher). |
| **Relationships** include physical proximity, shared activities, peer assistance, matched affect, and/or social conversation. | Observers noted close physical proximity among teachers and students (e.g., sitting on the floor with students), matched positive affect (i.e., teachers and students smiling and appearing happy and enthusiastic together, not one or the other appearing despondent), as well as some instances of students helping each other and sharing activities with the teacher (e.g., building with waffle blocks together).. |
| **Respect** includes eye contact, warm/calm voice, respectful language, and/or cooperation/sharing. | Observers noted frequent use of polite language such as "please," "thank you," and "yes, ma'am" from students and phrases such as "thank you very much for sharing" from teachers, along with frequent eye contact and a warm/calm tone of voice from teachers. |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas prekindergarten classrooms, May 2016

## Teacher Sensitivity Dimension

**Best Practices Observed.** Among the teachers who scored the highest for Teacher Sensitivity (i.e., top 10%), all four indicators of this dimension were observed: Awareness, Responsiveness, Addresses Problems, and Student Comfort. While Awareness was observed and coded for nine out of the ten highly-scored teachers, Responsiveness, Addresses Problems, and Student Comfort were coded less frequently.

**Table E.2: Promising Practice Examples for the Teacher Sensitivity Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Awareness** was the most prominently observed indicator. It is defined as teachers anticipating problems and planning appropriately, and/or noticing lack of understanding/difficulties. | "*The teacher was aware that counting by 50s was too large for the students to exercise, and he used it as a learning point for students to identify the $50 bills and put them aside.*" |
| **Responsiveness** is defined as acknowledging emotions, providing comfort and assistance, and/or providing individualized support. | Observers in this study often noted teachers' responsiveness in the same instances of their awareness:<br><br>"*The teacher was consistently aware of and responsive to potential issues (e.g., [she] helped children who had trouble cutting by putting smiley faces on their thumbs to remind them the right way to point the scissors).*"<br><br>"*Teacher effectively identified students who were struggling and provided timely support and attention (e.g., students who were emotionally upset, [n a disagreement with other students, etc.).*" |
| **Addresses Problems** is an indicator marked by helping in an effective and timely manner, and/or helping to resolve problems. | As an example from the observed teachers who scored highly for this dimension, one teacher quickly helped a student figure out how to participate at a center when his boots were too cumbersome, and the teacher also effectively resolved a conflict between two students playing with the same building blocks. |
| **Student Comfort** includes students seeking support and guidance, freely participating, and/or taking risks. | "*Students were very comfortable answering questions in the whole group session and sharing their work with the teacher.*" |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas prekindergarten classrooms, May 2016

## Regard for Student Perspectives Dimension

**Best Practices Observed.** Among the teachers who scored the highest for Regard for Student Perspectives (i.e., top 10%), all four indicators of this dimension were observed: Flexibility and Student Focus, (Lack of) Restriction of Movement, Student Expression, and Support for Autonomy and Leadership. Observations for all 6 highly-scored teachers were coded for (Lack of) Restriction of Movement.

**Table E.3: Promising Practice Examples for the Student Perspectives Dimension, 2016**

| Indicator | Examples |
|---|---|
| The **Flexibility and Student Focus** indicator was observed less often than the other indicators for this dimension; it is marked as the teacher showing flexibility, incorporating students' ideas, and/or following students' lead. | *"[The teacher] consistently incorporated children's ideas and followed their lead at centers (e.g. talking about what the nursery rhyme puzzle looked like before asking child to recall the rhyme)."* <br> *"[The teacher was] flexible in incorporating student ideas (child wanted to sing 'De Colores,' [teacher] asked the class if that would be okay, saying, 'Do you want to do instruments again?')."* |
| **Lack of) Restriction of Movement** was the most frequently coded indicator and is defined as allowing movement and/or not being rigid with students' movement and placement. | *"Centers were free choice for children to choose and move freely between without set transition times."* <br><br> *"Very little restriction of movement was observed."* |
| **Student Expression** is defined as encouraging student talk and/or eliciting ideas/perspectives from students. | *"The teacher regularly followed students' lead on comments, even when they were only tangentially related to lesson, and she acknowledged the value of a student's input, asking one or two follow-up comments or questions. Students were given responsibility and leadership opportunities to come to the front of the class and answer questions and write on white board (as teacher was modeling what the small group sessions would involve). Teachers constantly encouraged student talk from the student being asked questions and of other students adding onto the initial student's answer."* <br><br> *"Lots of student expression and teacher encouraged children to repeat/tell their friends what they shared with her (e.g., 'That is so creative, did you share it with your friends over there?')."* <br><br> *"[The teacher] encouraged students to talk and share feelings ('Justin has words.')."* |
| **Support for Autonomy and Leadership** includes allowing choice, allowing students to lead lessons, and/or giving students responsibility. | *"[The teacher gave] students some choice (e.g., songs, instruments/scarves, dancing) and responsibilities (e.g., asked one child to pick a friend to help get scarves for dancing; asked another to pick her an instrument)."* <br><br> *"[Students had] lots of choice and freedom to move from center to center, choose [their own] activity at each center and [the] responsibilities given to children [like] closing [the] door and passing out name tickets for centers (i.e., the teacher's 'little teacher' for the day)."* |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas prekindergarten classrooms, May 2016

# Classroom Organization Domain

## Behavioral Management Dimension

**Best Practices Observed.** Among the teachers who scored the highest for Behavioral Management (i.e., top 10%), all four indicators of this dimension were observed: Student Behavior and Redirection of Misbehavior were coded relatively more than Clear Behavioral Expectations and Proactive.

**Table E.4: Promising Practice Examples for the Behavioral Management Dimension, 2016**

| Indicator | Examples |
|---|---|
| **Student Behavior** is marked by frequent compliance and/or little aggression/defiance from students. As the CLASS PreK manual notes, "If there is no evidence of student misbehavior, it is assumed that effective behavioral strategies are in place and a classroom may score in the high range." | For 11 of the 14 teachers that scored highly for the Classroom Organization dimension, observers noted very well-behaved classrooms with little or no misbehavior. |
| **Redirection of Misbehavior** includes the teacher's effective reduction of misbehavior, attention to the positive behavior, use of subtle cues to redirect, and/or efficient redirection. | Among the teachers who scored highly for Classroom Organization, 12 were coded for effective redirection of misbehavior and most of those were specifically noted for using subtle cues and attention to positive behavior to redirect minor transgressions. *"[The] teacher commented several times, 'I like the way you all are sitting on your pockets and listening.'"* *"[The teacher used] subtle cues (e.g., 'please put your great brains to work') and attention to positive behavior ('I like the way my friends are working')."* *"Using cues like 'Show Me Ready' or 'I don't see people sitting down' were enough to get students focused on learning."* |
| **Clear Behavior Expectations** is indicated through the teacher having clear expectations, consistency across scenarios and between teachers/adults in the classroom, and/or clarity of rules. | *"The teacher went over classroom rules (e.g., walk, listen, clean up, take care of school, [and keep] hands, feet, and mouth to yourself) and engaged the class in a discussion Q&A about why each rule was important and why they are in place."* |

Source: *Classroom Assessment Scoring System PreK Manual* (Pianta, La Paro, & Hamre, 2015); Examples derived from observer notes of observations of Texas prekindergarten classrooms, May 2016