The Effect of Publicly Provided Pre-Kindergarten Community Approach Programs on Wisconsin District-Level Test Scores

By

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Abstract

Since the turn of the millennium, there has been a significant increase in the number of Wisconsin school districts offering pre-kindergarten programs. Among these programs, districts either employ the traditional or the community approach. However, there is very little literature documenting the potential impact of these programs on future educational outcomes. This paper examines the community approach and the traditional approach to pre-kindergarten programs relative to districts with no publicly funded pre-k. I use panel data over the early expansion of these pre-k programs across Wisconsin school districts in conjunction with OLS, fixed effects, and multinomial logit estimations. I find that when time invariant unobserved heterogeneity is accounted for in a fixed effects model, the community and traditional approach programs do not significantly impact math or reading test scores compared to districts with no publicly funded pre-kindergarten in the fixed effects.

1. Introduction

In 2000, there were 3.7 million three to four year olds enrolled in some form of pre-kindergarten or nursery education program across the United States (U.S. Census Bureau, 2016). By 2013, the number of children enrolled has increased to over 4.4 million. The rapid growth of early childhood education programs demonstrates the need to examine their educational benefits. Wisconsin has one of the most progressive education systems in the United States; therefore, it is a great platform to examine the changing landscape of publicly provided pre-kindergarten.

Wisconsin has experienced rapid growth in the number of school districts offering publicly funded pre-k educational programs over the last 15 years. Of the 415 Wisconsin school districts in 2002, there were 248 that did not offer any type of publicly funded pre-kindergarten program. By 2014, the number of districts without these programs had significantly declined to just 27. Districts with pre-kindergarten programs have either adopted the traditional approach or the community approach to education. The traditional approach is defined as a pre-k program, which requires a minimum of 437 hours of direct pupil instruction at the school location for the given school year.[1] The community approach faces the same hour requirement, but has a few key differences from what is defined as the traditional approach. The community approach for pre-kindergarten is a

[1] The hour requirement is according to Act 48 section 2 by the Wisconsin Department of Instruction

comprehensive program combining traditional publicly funded four-year-old pre-k with additional childcare programs on or off school grounds to create a "school-community interface" also known as "wraparound care." Since many parents work during the day, the community approach offers a way for children to receive both pre-k and childcare. By combining the two approaches, it presumably provides many benefits for the students, parents, and the school district.

Currently, there are relatively few existing studies on the academic or social benefits of publicly provided pre-kindergarten programs. This paper focuses on publicly funded traditional and community approach pre-kindergarten programs in Wisconsin school districts. I conduct a district level analysis that provides insight from what is essentially a census of Wisconsin students, as all students are accounted for in the district level data. Hence my analysis is representative of the population of Wisconsin students instead of a sample. This type of information is a very useful supplement to individual level data when making policy decisions because boards of education and superintendents frequently make decisions at the district level. The goal of this paper is to shed light on the characteristics of districts with traditional pre-k and community approach pre-k, and evaluate program efficiency in comparison to districts without publicly funded pre-k. In addition to examining district characteristics, this paper also examines the impact of pre-k on fourth grade test scores, and the reasoning behind why districts utilize the type of early childhood education they do.

This study consists of the estimated impact of community approach and traditional approach programs on fourth grade WKCE scores, relative to districts with no publicly

funded pre-k. I find that after controlling for time invariant district-level unobserved heterogeneity with fixed effects, pre-k program type does not significantly impact math or reading test scores. Although I do not find a significant impact on fourth grade WKCE scores, there are several potential benefits I discuss that may come along with a district adopting a pre-k program.

The second section of this paper discusses relevant background information regarding pre-k in Wisconsin. The third section is a review of relevant existing literature, the fourth section covers the data and descriptive statistics, the fifth section reviews the empirical models and results, and last is a conclusion along with a discussion of policy implications and future research agendas.

2. Background

An excerpt from the Wisconsin Constitution established in 1848 called for the establishment of district schools that "shall be as nearly uniform as practicable, and such school shall be free of charge or tuition to all children between the ages of 4 and 20 (Wisconsin DPI)." However, after policy was in place there was a significant decline in pre-k enrollment beginning in 1920. The kindergarten movement began to be replaced with an effort to focus on structuring grade levels in an attempt to increase high school enrollment. Part of the decline in kindergarten enrollment was due to WWII when many women started working, which created a large demand for childcare.

Following WWII, Head Start was established in the early 1960's as an early childhood education program to aid impoverished families. This phase of pre-k lasted until 1980, and by then only six districts offered pre-k using local district funding because of the shift in focus to high school attainment. In 1984, the state decided to bring back pre-k funding because of increased interest in demand for pre-k programs, as a growing number of mothers entered the workforce. Then in 1991, the Wisconsin legislature provided additional fiscal incentives in the funding formula for school districts to engage in outreach activities with parents.

Beginning in the 1990s, pre-k saw resurgence like it had not seen for over 70 years due to two reasons: more mothers entered the workforce and districts received increased financial benefits. By the 2009-10 school year, 80% of districts offered pre-k programs. Moreover, since the turn of the millennium the community approach to pre-k has developed into what it is today. Currently, 376 districts employ some type of publicly funded pre-k program, and only 25 do not. Furthermore, districts now adopt community approach programs at an increasing rate relative to traditional pre-kindergarten programs. Wisconsin continues to be one of the most progressive states educationally, and one that presents a unique environment for pre-k evaluation.

2.1 HeadStart

A large component of the community approach often intertwined with traditional schooling is Head Start. Wisconsin has 39 Head Start and 27 Early Head Start programs that serve over 15,000 children (14,377 preschoolers). It is a mostly federally funded

program for pre-school children from low-income families, who 95% of the times are at or below the federal poverty line (Head Start, 2016). Head Start is composed of a variety of educational and recreational activities, and also offers several benefits such as free medical and dental care for children. Over 94% of Head Start is federally funded through the Administration for Children and Families (ACF), and the remaining 6% is funded by Wisconsin Department of Instruction through The Head Start State Supplemental Grant (HSSSG). To put state funding in perspective, Wisconsin has $6.25 million in state funds to distribute to Head Start programs for the 2016 school year. Head Start is often a primary component to the community approach, and can be located within an elementary school, preschool, childcare center, or local family recreational places like the YMCA.

2.2 Benefits of the Community Approach

The Wisconsin DPI cites 54 benefits of the community approach broken down into five categories: children, families, education programs, school districts, and the general public. Below, I elaborate on how the community approach benefits each of the five categories.

First, children experience fewer transitions during the day by remaining in one location for both school and childcare, reducing the stress of switching locations and the cost of transportation. The community approach increases the continuity of care through children remaining in a familiar setting with consistent rules, routines, and expectations (Wisconsin DPI).

Facilities are also specifically designed for children under the age of six. Prior to the community approach era, special needs children were often placed in segregated classrooms. Since the community approach was implemented, special needs children are more often placed into inclusive settings with other developing children. One such district is Steven's Point that has experienced inclusion, and the pre-k community approach coordinator describes their situation as "getting the experience of being in a regular educational setting." The coordinator states that they are getting opportunities they never had before for example, teaching in a different setting, such as a YMCA. The community approach may also make the transition easier when entering kindergarten by allowing children to experience academic, and social settings at a young age that they otherwise would not. Additionally, children who need special services such as therapy can get it without having to leave their early childhood facility in certain instances.

Second, families are also impacted by community approach programs and realize several potential benefits such as an increased likelihood that children of working parents can attend a pre-k program. Parents can select the pre-k program that best fits the needs of their family based on factors such as geographical, academic, or social needs. Maybe the most important benefit with regard to the community approach is that children can get a high quality educational experience that is not necessarily dependent on the family's income or availability to transport their kids to school. Additionally, parents are provided the opportunity to become more engaged in the community with their children through family fun nights at businesses or recreational places, and various parent educational programs through the school.

Third, program educators may also receive benefits from a district using the community approach by attending and participating in school district training sessions. This may foster idea sharing and communication between all parties involved in educating pre-k students. Community site coordinators often request professional development training on new and relevant topics sought out by their staff. The staff of school districts is also able to attend professional development training sessions, and because of pooled resources, national level speakers come and share information with school personnel.

Fourth, the community approach offers financial assistance that was not present before the program installment. The general "wealth" of the school district can be shared with childcare programs that may have faced funding problems before, through new collaborative partnerships within the community. These partnerships include things such as the school district refurbishing facilities for community sites, purchasing new materials, or paying a portion of the maintenance costs for community sites.

Finally, community approach programs increase efficiency by sharing or consolidating space and resources. Hosting school and childcare at a site in the community that is not a formal school building can reduce the need to spend money on new buildings and facilities due to space constraints. Operational expenses of school districts such as custodial costs also get reduced by not having to pay for building maintenance.

The community approach enables unique program design that can be catered to the varying needs of each school district. Each district faces different obstacles whether they are building constraints, financial constraints, or transportation issues. Integrating school and childcare can cater to the needs of each individual district. Districts can set policy to fit their own unique set of criteria to avoid the one size fits all style of early childhood education.

2.3 Funding for Pre-k and the Community Approach

In order to receive funding, districts must meet one of three program standards. The first standard is at least 437 hours of class time instruction. The second is a minimum of 350 hours instruction, with 87.5 hours of the outreach activities described in the previous section. Third, the highest hour requirement is 437 hours of instruction coupled with 87.5 hours of outreach activities. In addition to the hour requirements, there are four standards a district must abide by to receive general aid. First, pre-k services must be accessible to all 4-year olds in the district. Second, the classes must have an appropriately licensed 4-year old kindergarten teacher. Third, the district must meet the support staff, special education, transportation, and curriculum statutes. Fourth, parents of students are not charged tuition for any part of the main pre-k program.

Districts receive funding for pre-k programs through a combination of state aid and district financing, and districts without a pre-k program that are looking to adopt one, can receive start-up grants from the state to fund initial costs. Cycle one of start-up grants began in the 2008-09 school year providing $3 million to districts for starting pre-k

programs, giving preference to school boards that use the community approach to early childhood education.

Between traditional and community approach pre-k programs, the average cost per pupil is approximately $12,000. For a district with 100 students enrolled in pre-k, they would see a total cost of $1.2 million. These costs make it imperative to examine the effectiveness financially, educationally, and socially on all members of the community.

3. Literature Review

Numerous studies have examined the effects on early childhood educational programs and their long-term benefits. In this section, I document the literature focusing on six different papers that cover a range of early education topics related to early education enrollment, and the potential benefits realized from them later in life.

This study is closely related to Artz and Welsch (2016). They investigate the impact of publicly provided kindergarten programs on fourth grade math and reading test scores in Wisconsin school districts. While other studies use individual or school level data to analyze the effects of early childhood education, Artz and Welsch (2016) make use of data at the district level. This is pertinent to policy recommendations since education policies are often set at the district level. The authors employ OLS and fixed effects methodologies to examine fourth grade district level test scores, and their findings on kindergarten programs provide grounds for my research. They find that once the time invariant unobserved heterogeneity across districts is accounted for, kindergarten

programs have a small, but significant positive impact on a cohort's fourth grade math test scores. This suggests that the pre-k programs I examine would likely have a positive impact on math and/or reading test scores.

McKie et al. (2011) examine potential strategies for early childhood education by looking at two learning measures for pre-k similar to the WKCE.[2] Pre-k curriculum is the basis for all future learning, and reading along with math are two of the core subjects. They state that, in general, children learn to read better in environments that are very nurturing. Results show that increasing reading opportunities can lead to better learning outcomes. The findings of this study potentially indicate that reading scores are worth analyzing along with math scores when it comes to the type of pre-k programs.

An important determinant in the benefits of early childhood education is the quality of the environment students are faced with in their homes. Bradley et al. (2011) evaluate how home environment plays a role in the success of Early Head Start (EHS) programs. They observe the impact EHS programs had on students at the age of 3 and found that children who were enrolled in EHS programs had higher scores than children who were assigned to the comparison group. However, there were no significant effects of the EHS programming when children we re-examined at the age of 5. Their findings bear relevance to this study since the education effects of the EHS programs seem to be short-lived (3-4 years of age) and fade out in the long run.

[2]The two measures are The Early Language and Literacy Classroom Observation (ELLCO) and The Early Childhood Environment Rating Scale Revised Edition (ECERS-R)

To get a better measure of long-term benefits of early childhood programs, Muenning et al. (2011) draw on a randomized control trial in North Carolina where infants were randomly enrolled in the Carolina Abecedarian Project (ABC). Infants were enrolled in the program from 1972 to 1977 at the Frank Porter Graham Child Development Institute. Randomly 111 infants received access to this early education program, then behavioral and health outcomes were assessed when individuals reached age 21. These infants were selected for the program if they were healthy, and scored as high risk for poor educational outcomes based on a sociodemographic risk index.

The authors found that the ABC program significantly improved overall health outcomes and behaviors relative to the comparison group. Individuals who were in the program were also likely to start smoking at a later age, and smoked less frequently. This study suggests that pre-k programs benefit the health behaviors of children, along with the previous studies that suggest there are additional academic benefits.

While the previous studies focused on the academic and health benefits of pre-k enrollment, Chien et al. (2010) looks at how successfully students learn with different types of instruction. The authors examined potential gains from prekindergarten through the varying levels of engagement.[3] Engagement consists of four varying levels of student-teacher interaction including: free play, individual instruction, group instruction, and scaffold learning. They use percentage of students eligible for free and reduced lunch as a proxy for, as is the same with this study. Their findings suggest a link between classroom

[3] Data came from the National Center for Early Development and Learning Multi-State Study of Pre-kindergarten and the State-Wide Early Education Programs Study (SWEEP)

engagement and poverty status. Teachers reported that when working with children of higher socioeconomic status, they were able to develop skills by utilizing indirect methods of literacy and math. Compared to higher income students, poorer students made smaller gains in various measurements, such as, highest number counted, letter-word identification, and Woodcock Johnson[4] applied problems. The results demonstrate how important variables like income and other home characteristics are when looking into causal factors of childhood educational attainment.

The final paper I review examined the benefits of students enrolled in Head Start programs. Head Start is one of the most common components of the community approach for Wisconsin school districts. Bierman et al. (2014) examined children who participated in the Head Start Research-based Developmentally Informed (REDI) intervention. The REDI program was established in 2003 by multiple federal agencies to create interventions that would enhance the school-readiness for at-risk children. Linear analysis demonstrated that REDI intervention promotes learning engagement, competent social problem-solving skills, and reduced aggressive behavior. They found that gains in literacy were associated with better quality student-teacher interactions, teachers rated students who were enrolled in the Head Start REDI program as more engaging, and that children enrolled in REDI offered more competent solutions to problems than the control group of children. Children enrolled in community approach programs are often in Head Start, this study shows the positive learning and social outcomes of the program.

[4] The Woodcock Johnson test is a measure of academic achievement consisting of a wide variety of brief tests

McKie et al. (2011) and Muennig et al. (2011) provide statistically significant and positive evidence regarding the potential success of early childhood education programs. The literature cited in this paper and throughout this field suggests that students learn differently based on their genetics, home environment, and quality of early education programs. According to this set of papers, enrolling students in pre-k programs can potentially increase academic success, health, and behavioral outcomes particularly for low-income families.

4. Data

Data used in this study comes from the Wisconsin Department of Instruction website, and is publicly available. The dataset contains 13 years of district level data beginning in the 2001-02 school year through 2013-14 and includes all Wisconsin school districts.[5] Math and reading scores are measured by examining fourth grade standardized test scores over the 13-year panel. Wisconsin's method of standardized testing is the Wisconsin Knowledge and Concepts Examination (WKCE) and includes subjects such as math, reading, language arts (and writing), science, and social studies. Due to existing research and No Child Left Behind (NCLB) evaluation standards, I narrow the analysis to how pre-k programs impact math and reading scores.[6] In order to observe the impact of a pre-kindergarten community approach on WKCE scores, pre-k program enrollment is linked

[5] Districts are only missing because they did not report to the DPI for that given year
[6] NCLB standards dictate that a district should have a goal to place all children to test in either the "Advanced" or "Proficient" categories.

to test scores 5-years later. This 5-year lag restricts the observations used in the estimations to the years 2007 to 2014, reducing the sample size to 7 years.

The full data set with all of the years included has 5,295 observations. However, the dependent variables of math and reading test scores only have approximately 3,200 observations because of the lag requirement to match fourth grade test scores to pre-k demographic data. Mean enrollment across the approximate 420 districts is 2,091 per district. Accounting for all years in the study, there are over 11 million students within the districts.

The set of independent variables used in this study follow existing literature in the field of early childhood education, especially papers about pre-kindergarten. In particular, I closely follow the specifications of Artz and Welsch (2016). The set of demographic variables are all at the district level and they include: the total attendance rate of students, cost per pupil, pupil-teacher ratio, the percentage of teachers with at least a Master's degree or higher, the average teaching experience of educators, and the average salary of teachers in the district.

Most of the studies that have looked at early childhood education programs use student level data, instead of district level. Student level data allows for more precision with estimates, and analysis is specific to the individual school. What examining data at the district level lacks in precision, it can make up for with two key benefits. The first advantage is that using district level data in this case essentially forms a census of data, and can account for all students. The second is that school district administration can use

the district level findings for future policy making decisions, as nearly all school administration decisions are carried out at the district level.

4.1 Wisconsin Knowledge and Concepts Examination Metrics

Beginning in 1996-97, the Wisconsin Knowledge and Concepts Examination (WKCE) began to be administered to students in grades 4, 8, and 10 as a measure of student knowledge and skills in mathematics, reading, language arts, science, social studies, and writing. In 1997-98, the WKCE used the TerraNova exam series developed by McGraw-Hill and results were reported in terms of four proficiency categories: minimal, basic, proficient, and advanced. These categories were developed by a scale used by TerraNova, along with a standard-setting process. They also incorporated over 200 Wisconsin educators, citizens, and business leaders. The categories have since been refined and improved after multiple alignment studies every few years. The test is now standard-focused to assure students have the necessary education to proceed to the next grade, and remains a useful tool for determining adequate yearly progress (AYP).

Originally, the *minimal* level was defined as demonstrating very limited academic knowledge and skills. *Basic* level demonstrated some academic knowledge and skills. *Proficient* level demonstrated competency in the academic knowledge and skills. *Advanced* level demonstrated in-depth understanding of academic knowledge and skills.

However, in 2012, the definitions of the four categories were modified. *Minimal* performance was changed to demonstrating limited knowledge and skills in the subject matter and limited ability to apply knowledge and skills effectively. *Basic* demonstrates

partial mastery of prerequisite knowledge and skills that are fundamental for proficient work. *Proficient* demonstrates a solid understanding of challenging subject matter and ability to solve a wide variety of problems. *Advanced* demonstrates a comprehensive and in-depth understanding of rigorous subject matter and provides sophisticated solutions to complex problems. The last four descriptions are the most recent and up to date definitions for the WKCE.

I examine each cohort of students, and the impact the community approach, traditional approach, and no public pre-k have on them. In addition to examining them individually, they are analyzed in groups of "Advanced/Proficient" which is simply the sum of the percentage of students who test advanced or proficient. I take a look at this grouping because the goal of No Child Left Behind is to have all students achieve one of these learning measures. Also, I separated them into this group because according to the Wisconsin DPI, if a district fails to meet performance requirements it is the job of the superintendent to identify the district, and propose a solution to help increase test scores, which could lead to relevant policy implications.[7]

I observe different impacts and levels of significance with each test category, and all four are used to create the main dependent variable, which is a GPA equivalent measure. I define GPA as the following:

$$GPA = (4 \times PctAdvanced) + (3 \times PctProficient) + (2 \times PctBasic) + (1 \times PctMinimal)$$

[7] District performance requirements vary by district

By looking at WKCE test scores as a continuous GPA measure it accounts for all four categories variation, and provides an accurate, comprehensive measure applicable to the grading scale used for students in all grades across the United States.

4.2 Descriptive Statistics

Descriptive statistics (Table 1) are broken down by pre-kindergarten program type with the mean and standard deviation of variables on both sides of the estimation equations. Intuitively, when looking at mean GPA, an individual would likely expect students who attend pre-k programs to score higher on fourth grade test scores than students who did not attend a publicly funded pre-k program on average according to papers like Artz and Welsch (2016) and Bierman et al. (2014).

Perhaps surprisingly, districts not offering publicly funded pre-k programs have slightly higher fourth grade math and reading test scores than districts that offer the community or the traditional approach. This could demonstrate one of the potential issues with my analysis because no public pre-k is a heterogeneous group. Although pre-k is not publicly offered for a given district, there are several other possibilities children may have for early learning, such as, private school and childcare that are not accounted for. Moreover, parents can choose to educate their kids at home until they are old enough for kindergarten. The quality of education a child receives under those circumstances can vary tremendously, creating noise within the data. Having a stay-at-home parent spending time with their child all of the time, and actively teaching them could potentially lead to a

better outcome then children who attend public pre-k. On the other hand, parents who spend less time educating their children could negatively impact learning outcomes.

Many covariates are also potentially of interest. The percentage of students eligible for free and reduced lunch, is a measurement reflective of economic status. Districts with a high percentage of students FLE (free lunch eligible) are presumed to be financially worse off. Looking at the program breakdown in Table 1, districts that employ the community approach have a higher percentage of students FLE (40%) than districts using a traditional approach (37%), or no publicly funded pre-k at all (27%). The socioeconomic status of families likely has an important role to play in the type of education their children will receive. Families with high income can afford to send their children to private programs, or if one parent earns a high income the other can stay home to educate their child who may benefit more from one on one time with a parent, than in a classroom setting with a large pupil-teacher ratio.

The percentage of minority students in a district is another important factor to consider. Community-approach districts have five percentage points more minority students than districts with traditional approach or no public pre-k at all. Studies have shown that racial demographics are often correlated with income (House and Williams, 2000). In this study, my income proxy variable is free and reduced lunch eligible. Districts who use the community approach have a higher percentage FLE, and a larger portion of minorities relative to districts with the traditional approach or no publicly funded pre-k. This is unsurprising since these districts commonly employ Head Start programs, which as stated earlier, is a federally funded program for families at or below

the federal poverty line. Since low-income students on average test lower than high-income students, the relationship potentially shines light on why districts with no publicly funded pre-k have higher average test scores than traditional or community approach districts. Congruent with the FLE and minority descriptive statistics, the pupil-teacher ratio is larger for districts that use the community approach than the other two program types. Moreover, teachers have less experience in community approach districts, relative to traditional approach and districts without publicly funded pre-k.

5. Results

5.1 Preliminary OLS Results

The baseline estimation to examine the relationship between fourth grade WKCE test scores and pre-kindergarten program type employs a OLS methodology without any control variables, such as, demographic controls, year dummies or district fixed effects. The model takes on the form:

$$TS_{dt} = \beta_0 + \beta_1 \text{Pre} - k_{dt} + \varepsilon_{dt} \quad (1)$$

where $\mathbf{TS_{dt}}$ are the fourth grade WKCE scores for district $\boldsymbol{d}$ in year $\boldsymbol{t}$; $\boldsymbol{\beta_0}$ is a model specific constant term; $\mathbf{Pre\text{-}k_{dt}}$ is pre-kindergarten program type; and $\boldsymbol{\varepsilon_{dt}}$ is a random error term. Table 2 presents the results from this OLS estimation.

I find negative and significant results across both test subjects, and the percent of students testing either advanced or proficient for the community approach, and traditional

approach districts relative to no publicly funded pre-k. These results indicate that districts using the community approach or the traditional approach for pre-k have lower test scores than districts without a publicly funded pre-kindergarten program.

On average, districts using the community approach have slightly higher math test scores than districts using the traditional approach, relative to districts without publicly funded pre-k. However, when examining reading test scores, districts with the traditional approach test higher on average than districts using the community approach. This is congruent with existing literature, and provides some insight into the relationship between pre-k program and test scores. I perform this estimation to establish simple associations between the main variables of interest. However, this analysis lacks practical interpretation that OLS with controls, fixed effects, and multinomial logit provide.

5.2 OLS with Controls

Following the established research on early childhood education programs such as Artz and Welsch (2016), I first modify my previous OLS model to the following:

$$TS_{dt} = \beta_0 + \beta_1 CA_{dt-5} + \beta_2 Traditional_{dt-5} + \beta_3 \mathrm{X}'_{dt} + \tau_t + \varepsilon_{dt} \quad (2)$$

where $\mathbf{TS_{dt}}$ are the fourth-grade test scores for district ***d*** in year ***t***; $\boldsymbol{\beta_0}$ is a model specific constant term; $\mathbf{CA_{dt-5}}$ is a continuous dummy variable that measures the proportion of students attending the community approach pre-k program in year *t-5*; $\mathbf{Traditional_{dt-5}}$ is a continuous dummy variable that measures the proportion of students attending a traditional pre-k program in year *t-5*; $\mathbf{X'_{dt}}$ is a vector of control variables which includes

district level demographic characteristics. Additionally, the model also includes year dummy variables (τ_t) and a random error term (ε_{dt}). Including the district fixed effect in the OLS estimation accounts for the variance of time when examining pre-k program type, and the impact on fourth grade test scores.

Table 3 shows the results from the OLS estimation from equation (2) which includes fourth grade math and reading GPA as the dependent variables, pre-k program type, the set of independent controls, time dummies, and district fixed effects. Columns one and two are math GPA and percent "A/P"; columns three and four are reading GPA and percent "A/P" respectively.

The estimation of math and reading GPA yields significant results for many covariates in the equation. Publicly funded community approach and traditional approach programs are negatively associated with both measures of GPA, relative to a district with no publicly funded pre-k. On average, a district utilizing the community approach will have .064 lower GPA than a district with no publicly funded pre-k significant at the 1% level. So while these results are statistically significant, they have a relatively small negative overall impact on GPA. This goes against the intuition of what many may originally believe to be the relationship between pre-k and test scores. Similarly, the estimate of the impact of the traditional approach to pre-k is also significant with a negative coefficient. However, the estimate has a smaller magnitude than my estimates for the community approach. For example, a district with a traditional approach will have

a .02 lower GPA than a district with no publicly funded pre-k on average holding all else constant, this result is significant at the 5% level for math and 1% for reading.

Aside from the pre-k program type variables, several other independent variables have a significant impact on math test scores. For example, holding all else constant, if there is a 10% increase in total attendance rate for a district with the community approach, the school district will expect a .1 increase in math GPA on average. This result is significant at the 1% level. This is intuitively appealing, in that, the more frequently students attend school, the more likely that they will test better than if they did not. This effect is nearly the same for reading GPA, and has a similar impact on the percent testing A/P.

Another significant variable that positively impacts math GPA is average teacher salary. For a $10,000 increase in teacher salary for a district with the community approach, I would expect a .082 increase in math GPA on average holding all else constant, this result is significant at the 1% level. Alongside total attendance rate, teacher salary has a small significant impact on both math and reading test scores.

Both community approach and traditional approaches predict lower test scores for their districts than districts not employing any kind of publicly funded pre-k. By controlling for the district characteristics, district fixed effects, and time, this estimation permits interesting discussion. These results, in combination with looking at the disparities in descriptive statistics present a few possibilities for inference. Potentially, districts who face adverse learning conditions may try to implement pre-k programs to

better prepare children for elementary school if there have been negative learning outcomes historically. In a sense, pre-k programs could be looked at as a correction in an attempt to better test scores in the long run. Additionally, districts facing constraints may decide to use the community approach to integrate childcare and Head Start into schooling already in place to get the benefits previously mentioned.

Along with math and reading GPA, the percentage of students who test advanced/proficient also yield significant results indicating the community approach and the traditional approach programs have a negative association with both A/P measures. Districts using the traditional or the community approach have a positive association with the percentage of students who test basic or minimal. Both of the coefficients for community and traditional pre-k are larger in magnitude relative to the equations for the GPA estimations. The results indicate that there is a direct negative relationship between test scores, and if the district employs the community or traditional approach.

There is also a small significant difference between the community approach and the traditional approach to pre-k. When including independent control variables and time components students enrolled in the traditional approach to pre-k test higher on the WKCE on average than students in the community approach. T-tests indicate that the two program types are significantly different from one another. On average, students who are enrolled in the traditional approach test 0.04 higher in math GPA than students in the community approach. This is consistent across both measures of math and reading WKCE scores.

5.3 Fixed Effects

The third model used in this study is the fixed effects model (equation 3). I employ fixed effects to account for time invariant unobserved heterogeneity. The specification takes on the following form:

$$TS_{dt} = \beta_0 + \beta_1 CA_{dt-5} + \beta_2 Traditional_{dt-5} + \beta_3 X'_{dt} + \delta_d + \tau_t + \varepsilon_{dt} \quad (3)$$

where $\mathbf{TS_{dt}}$ are the fourth grade test scores for district ***d*** in year ***t***; $\boldsymbol{\beta_0}$ is a model specific constant term; $\mathbf{CA_{dt\text{-}5}}$ is a continuous dummy variable that measures the proportion of students attending the community approach pre-k program in year *t-5*; $\mathbf{Traditional_{dt\text{-}5}}$ is a continuous dummy variable that measures the proportion of students attending a traditional pre-k program in year *t-5*; $\mathbf{X'_{dt}}$ is a vector of control variables which includes district level demographic characteristics $\boldsymbol{\delta_d}$, a district specific fixed effect that controls for any time invariant heterogeneity in each district. Additionally, the model also includes year dummy variables τ_t and a random error term $\boldsymbol{\varepsilon_{dt}}$.

The fixed effects model is the preferred specification of this study because of the ability to capture time invariant unobserved heterogeneity. Table 4 has the results from the fixed effects estimations for both math and reading GPA, and percentage of students A/P. Both the community, and traditional approaches yield insignificant results; meaning that there is no significant impact on math or reading GPA relative to no publicly funded pre-k holding all else constant.

Very few right hand side variables display a significant relationship with math and reading test scores. Cost per pupil and the percentage of teachers with a master's degree or higher are the only variables significant across all four estimations, and attendance rate has only a small relationship with math GPA and percent A/P.

Although the fixed effects model does not yield significant results for program type relative to no pre-k, there is still some inference that can be conducted. A potential explanation for these results is the limited number of community approach observations. With the lagged pre-k variables, it limits observations to earlier years when the community approach was not as commonly used in early childhood education. With only 130 community approach observations the precision of the model's estimates is rather limited. However, the traditional approach has 1,661 observations, which is likely a large enough sample size to generate acceptable levels of precision.

Moreover, the apparent difference between community approach and traditional approach appears to be minimal. A potential scenario is that there are initial benefits in math and reading associated with pre-k, but by the time children reach fourth grade and take the WKCE the effects of these pre-k programs have dissipated (Artz 2016). In addition, teachers may expend their effort and resources in early education years on catching children up who are behind, instead of teaching children who are already at the grade level standards advanced material. Third, while parents may perceive reading as a subject that needs to be taught at home before kids go to school, the same might not be the case with math (Ginsburg 2008). In fact, they find that parents are significantly less likely to teach their kids the requisite math skills at home, particularly in homes that face

economic disadvantages. The combination of these factors is evidence that while early education in math and reading math seem beneficial, the realized benefits may decline by the time students' academic achievement can actually be measured.

5.4 Multinomial Logit

In addition to the OLS and fixed effects models the third estimation used in this study is a multinomial logistic regression (multinomial logit). It is an extension of a logistic regression which analyzes dichotomous dependent variables, and assumes a logarithmic distribution. Another difference is that with a logistic regression magnitude of the coefficient is immeasurable, only the sign of the coefficient is open for interpretation. A benefit of multinomial logit is that it takes on the same distribution, and allows for more detailed coefficient interpretation when used in conjunction with a fixed effects model. In this instance, I examine pre-k program type as the dependent variable with no pre-k as the baseline group due to the quantity of observations. The multinomial logit model takes on the empirical form:

$$\mathrm{Pre-K}_{ij} = \log(\pi_{ij}/\pi_{ij}) = \alpha_j + \mathrm{X'}_i\beta_j \qquad (4)$$

The purpose of this model is to look at the variables used in this study in a different way, and observe how the set of independent variables relate to pre-k program type. I do this because there is a possibility districts are pre-disadvantaged by demographic factors such as income. The only variable significant below the 1% level for both community approach and traditional is the percentage of student's free lunch eligible. FLE is positively associated with both the community approach and the traditional approach

which indicates that districts using either of these pre-k program types are more likely to have a larger portion of FLE students than districts with no publicly funded pre-k. This finding is congruent with both the OLS and fixed effects estimations, that districts using the community approach on average have more students who are FLE. The only other significant variable for the community approach is cost per pupil at the 10% level. Cost per pupil is also significant for traditional pre-k at the 5% level, in addition to pupil-teacher ratio at the 5% level and percentage of teachers with a Master's or higher at the 1% level.

5.5 Caveats

Unfortunately, the data faces limitations because of the recent increase in districts utilizing the community approach, and the required lag on pre-k programs which reduces the panel data by five years. There were no districts recorded using the community approach before 2005, and because of the lagged variables districts after 2009 are of no use at this moment in time. This means that with the 8-year panel dataset, community approach districts only have 130 observations. This significantly limits the power of the estimation, but according to the law of large numbers it is still a large enough sample size to effectively conduct analysis. Currently, the lack of observations in the data set is a negative, but as the sample size increases over time this problem will go away in a few years.

Also, all data is publicly available from the Wisconsin DPI website, and reported at the district level. Using information at the district level has its benefits along with its

drawbacks. The benefit is that the data is basically a census and incorporates all students in Wisconsin schools directly or indirectly. Also, policy implications are often made at the district level so analysis can be a useful tool for school administration. The downside is that the data is too general to measure specific program quality or draw student level conclusions.

Third, it is not possible with the current data to match school and home demographic characteristics. Several things would be beneficial, if not at least interesting to measure from the home side such as year to year population, household income, or parents' education. This limits the variables that can be used, but the district level data is still powerful enough to do analysis with. With more resources available this problem also could be solved, but the time and cost of obtaining the data just may not be feasible.

Fourth, there is a potential issue with multicollinearity in the estimations. Several of the right-hand side variables have a high covariance, which can increase standard errors. As standard errors increase, it decreases the size of the test statistics, decreasing the precision of the estimators. If I were to correct the multicollinearity by removing a variable from the equation, it would do more harm than good by creating omitted variable bias.

Finally, the program type "no publicly funded pre-k" has a heterogeneous nature. Districts without publicly funded pre-k have several alternatives families may choose to use. Private schools, private childcare, charter schools, and home schooling are all options that fall under the umbrella of no publicly funded pre-k. These options create an

identification issue when measuring the WKCE results of districts with a community or traditional approach against districts without publicly funded pre-k.

6. Conclusion

States across the country have been instituting more pre-k programs over the last 15 years. With millions of children attending these programs, and millions of dollars being used to fund public pre-k it is critical to analyze the benefits at varying levels. The majority of existing research examines school or individual level data, and often places emphasis on low income families. While these studies are very useful, there is also a need to examine programs at the district level given that many of the school policies set by administrators are at the district level. Therefore, studies at the district level can provide powerful analysis in setting policy, and should be used in conjunction with studies focused on specific schools or individual students. The purpose of this paper is to examine the impact of publicly provided community approach programs on fourth grade Wisconsin school district test scores relative to districts with no publicly funded pre-k through OLS, fixed effects, and multinomial logit estimations.

Using a fixed effects model, I find that both the community approach and traditional pre-k programs do not have a significant impact on math or reading test scores. This result could be in large part due to a variety of different factors. The use of community approach programs in districts is still a relatively new practice, 2005 was the first-year districts started to implement the program in Wisconsin. This places a big limitation on

the availability of data because of the five-year lag on pre-k program type. More observations would greatly help to improve accuracy and reduce the noise. The solution would be to go back in a few years with an updated dataset, and do the analysis again under the same circumstances.

In addition to the limit on community approach observations, the pre-k program type "no pre-k" is a heterogeneous group. There are several other possible pre-k alternatives that families may use instead of sending their children to a publicly funded pre-k program such as private daycares, charters, and home education.

The primary questions of this study when looking at pre-k programs are (a) publicly funded pre-k programs worth the cost, and (b) is the community approach the best way to maximize the resources being used without sacrificing the quality of education. Districts with low test scores that are facing financial problems may view introducing pre-k as a solution to both cost and academic problems. The results from this study indicate that publicly funded pre-k, although insignificant, is a potentially good thing for school districts. Districts who have traditional or community approach pre-k have a higher percentage of student's free lunch eligible, and a larger percent of minority students than districts with no publicly funded pre-k. Therefore, by employing any type of public pre-k program students who have historically done worse in school because of demographic disadvantages can get a chance to begin learning sooner in life which could potentially lead to better outcomes later in life.

Further research should be conducted as more observations become available for districts using the community approach. Until then, the accuracy of the analysis is not all it could potentially be. At this time the fixed effects analysis yields insignificant results when examining the impact of publicly funded community approach programs relative to districts with no public pre-k. The fixed effects model also suggests that while insignificant, having the traditional or community approach to pre-k is at least not a bad thing. With more resources available there could be several interesting and important studies around pre-k programs, along with the potential academic and social benefits that come along with them.

References

"4KCA Impact." *Wisconsin Department of Public Instruction*. N.p., 28 Oct. 2013. Web. 08 June 2016.

Artz, B., & Welsch, D. (2016). The Impact of Publicly Provided Early Childhood Education Programs on District-Level Test Scores. *Contemporary Economic Policy*, 89(106).

Bierman, K. L., Nix, R. L., Heinrichs, B. S., Domitrovich, C. E., Gest, S. D., Welsh, J. A., & Gill, S. (2014). Effects of Head Start REDI on children's outcomes 1 year later in different kindergarten contexts. *Child Development*, *85*(1), 140-159. doi:10.1111/cdev.12117

Bradley, R. H., McKelvey, L. M., & Whiteside-Mansell, L. (2011). Does the quality of stimulation and support in the home environment moderate the effect of early education programs?. *Child Development*, *82*(6), 2110-2122. doi:10.1111/j.1467-8624.2011.01659.x

Chien, N. C., Howes, C., Burchinal, M., Pianta, R. C., Ritchie, S., Bryant, D. M., & ... Barbarin, O. A. (2010). Children's classroom engagement and school readiness gains in prekindergarten. *Child Development*, *81*(5), 1534-1549. doi:10.1111/j.1467-8624.2010.01490.x

"Early Childhood." *Wisconsin Department of Public Instruction*. N.p., 31 Dec. 1969. Web. 08 June 2016.

"Early Childhood 4 Year Kindergarten: Act 48." *Wisconsin Department of Public Instruction*. N.p., 31 Dec. 1969. Web. 14 June 2016.

"Equalization Aid Formula." *Wisconsin Department of Public Instruction*. N.p., 31 Dec. 1969. Web. 08 June 2016.

"Four-Year-Old Kindergarten Grants." *Wisconsin Department of Public Instruction*. N.p., 31 Dec. 1969. Web. 08 June 2016.

"Generalized Linear Model." *WWS 509*. N.p., n.d. Web. 08 May 2016.

"Head Start in Wisconsin." *Http://whsaonline.org*. N.p., n.d. Web. 8 June 2016.

"Head Start in Wisconsin." *Wisconsin Department of Public Instruction*. N.p., 31 Dec. 1969. Web. 08 June 2016.

House, James S., and David R. Williams. "Understanding and Reducing Socioeconomic and Racial/Ethnic Disparities in Health." *Health and Social Justice* (2003): n. pag. Web. 6 June 2016.

McKie, B., Manswell Butty, J., & Green, R. (2012). Reading, Reasoning, and Literacy: Strategies for Early Childhood Education From the Analysis of Classroom Observations. *Early Childhood Education Journal, 40*(1), 55-61.

Moeser, Jim. *Great Start Series: Policy Brief #5* (2010): n. pag. Sept. 2010. Web. 20 May 2016.

"MPS Per-pupil Spending Ranks High, Report Says." *MPS, Wisconsin Rank High in Per-pupil Spending*. N.p., n.d. Web. 08 June 2016.

Muennig, P., Robertson, D., Johnson, G., Campbell, F., Pungello, E. P., & Neidell, M. (2011). The Effect of an Early Education Program on Adult Health: The Carolina Abecedarian Project

"National Science Education Standards." (1996): n. pag. *Wisconsin Department of Public Instruction*. Web. 10 Apr. 2016.

Park, Kang H., and Peter M. Kerr. "Logit." *The Journal of Economic Education* 21.2 (2014): 101-11. Web. 15 May 2016.

"Percent of Population Ages 3 and 4 Who Are Enrolled in School: Census 2000." *Percent of Population Ages 3 and 4 Who Are Enrolled in School: Census 2000*. N.p., n.d. Web. 08 June 2016.

Petra E, Todd. Wolpin I, Kenneth. *USA. ON THE SPECIFICATION AND ESTIMATION OF THE PRODUCTION FUNCTION FOR COGNITIVE ACHIEVEMENT** (2003): n. pag. Web. 15 June 2016.

Randomized Controlled Trial. *American Journal of Public Health*, *101*(3), 512–516. doi:10.2105/AJPH.2010.200063

Stratton, Leslie S., Dennis M. O'Toole, and James N. Wetzel. "A Multinomial Logit Model of College Stopout and Dropout Behavior." *Economics of Education Review* 27.3 (2008): 319-31. Web. 10 May 2016.

"Welcome to the Institute for Digital Research and Education." *Annotated Stata Output: Multinomial Logistic Regression*. N.p., n.d. Web. 08 June 2016.

"Wisconsin's ACT Test Scores Keep High U.S. Ranking." *Wisconsin's ACT Test Scores Keep High U.S. Ranking*. N.p., n.d. Web. 08 June 2016.

"Wisconsin Legislature: 115.38." *Wisconsin Legislature: 115.38*. N.p., n.d. Web. 08 June 2016.

"WKCE / WAA-SwD Proficiency Data." *Wisconsin Department of Public Instruction*. N.p., 15 Nov. 2012. Web. 08 June 2016.

Table 1:
Descriptive Statistics

	Community Approach	Traditional Approach	No Pre-K
	(1)	(2)	(3)
Math GPA	2.48	2.48	2.52
	(0.19)	(0.24)	(0.24)
Reading GPA	2.14	2.15	2.20
	(0.190)	(0.25)	(0.23)
% FLE Total	40.55	37.33	27.72
	(12.78)	(30.99)	(14.62)
% Minority	15.92	10.89	10.85
	(12.80)	(12.66)	(11.79)
% Total Attend Rate	95.57	95.35	95.47
	(1.12)	(2.27)	(1.41)
Cost Per Pupil	12,390.72	12,933.13	12,256.56
	(1,121.91)	(2,024.92)	(1,695.6)
Pupil - Teacher Ratio	8.43	7.91	8.26
	(0.97)	(1.34)	(1.11)
% Masters or Higher	54.08	43.75	49.74
	(12.942)	(16.37)	(15.49)
Average Teacher Exp	14.67	15.29	15.25
	(2.10)	(2.72)	(2.10)
Average Salary	51,733.87	47,761.42	49,304.63
	(4,810.74)	(5867.17)	(5481.91)
Observations	126	1,628	1,473

Observations come from the Wisconsin DPI. Standard deviations are reported in parentheses. The sample is divided into the three pre-k categories: Community Approach, Traditional, and No Pre-K

Table 2:
OLS Analysis Without Controls

	Math		Reading	
	GPA	% A/P	GPA	% A/P
	(1)	(2)	(3)	(4)
Community Approach	-0.040**	-2.144**	-0.070***	-2.807***
	(0.019)	(1.044)	(0.018)	(0.848)
Traditional Approach	-0.0438***	-2.509***	-0.054***	-2.356***
	(0.009)	(0.509)	(0.009)	(0.401)
Constant	2.519***	52.447***	2.205***	38.365***
	(0.006)	(0.360)	(0.006)	(0.272)
R-Squared	0.0083	0.0077	0.0135	0.0114
Observations	3,211	3,221	3,216	3,217

Notes: ***, **, * denote significance at 1%, 5%, and 10% respectively. Observations come from the Wisconsin DPI. Standard deviations are reported in parentheses. The sample is divided into the three pre-k categories: Community Approach, Traditional, and No Pre-K. No Pre-K is the reference group for school program type.

Table 3:
OLS Analysis

	Math		Reading	
	GPA	% A/P	GPA	% A/P
	(1)	(2)	(3)	(4)
Community Approach	-0.064***	-4.114***	-0.063***	-2.828***
	(0.021)	(1.165)	(0.020)	(0.954)
Traditional Approach	-0.020**	-1.171**	-0.028***	-1.164**
	(0.010)	(0.572)	(0.010)	(0.456)
% FLE Total	-0.002	-0.103	-0.002	-0.085
	(0.001)	(0.076)	(1.4E-03)	(0.062)
% Minority	-0.004***	-0.219***	-0.006***	-0.228***
	(7.02E-03)	(0.039)	(7.3E-04)	(0.032)
% Total Attend Rate	0.010***	0.515**	0.011***	0.470***
	(0.004)	(0.217)	(0.004)	(0.164)
Cost Per Pupil	9.14E-06***	4.6E-04***	2.08E-05***	9.3E-04
	(2.96E-06)	(1.7E-04)	(3E-06)	(1.4E-04)
Pupil - Teacher Ratio	0.019***	1.206***	0.022***	1.117***
	(0.006)	(0.351)	(0.006)	(0.279)
% Masters or Higher	4.6E-04	0.028	4.07E-05	0.010
	(2.9E-04)	(0.017)	(2.9E-04)	(0.014)
Average Teacher Exp	-0.008***	-0.507***	-0.004	-0.196*
	(0.002)	(0.142)	(0.002)	(0.114)
Average Salary	8.20E-06***	4.5E-04***	8.64E-06***	3.5E-04
	(1.46E-06)	(8.3E-05)	(1.5E-06)	(6.6E-05)
Constant	1.127***	-18.7	0.465	-36.546**
	(0.398)	(23.612)	(0.389)	(17.763)
R-Squared	0.2154	0.2046	0.2316	0.2053
Observations	3,211	3,211	3,216	3,217

Notes: ***, **, * denote significance at 1%, 5%, and 10% respectively. Observations come from the Wisconsin DPI. Standard deviations are reported in parentheses. The sample is divided into the three pre-k categories: Community Approach, Traditional, and No Pre-K. No Pre-K is the reference group for school program type.

Table 4:
Fixed Effects

	Math		Reading	
	GPA	% A/P	**GPA**	% A/P
	(1)	(2)	(3)	(4)
Community Approach	-8.9E-04	-0.810	-0.002	0.097
	(0.017)	(0.963)	(0.017)	(0.918)
Traditional Approach	0.020	0.843	-5.7E-04	0.114
	(0.014)	(0.859)	(0.013)	(0.670)
% FLE Total	-2.4E-05	-0.003	4.75E-05	0.004
	(5.8E-05)	(0.003)	(5E-05)	(0.003)
% Minority	-1.1E-04	0.020	-0.001	-0.095
	(0.002)	(0.141)	(0.002)	(0.096)
% Total Attend Rate	-0.002*	-0.230**	-0.002	-0.059
	(0.001)	(0.101)	(0.001)	(0.086)
Cost Per Pupil	-1E-05**	-6.5E-04**	-1.3E-05*	-6.5E-04**
	(4.72E-06)	(2.8E-04)	(5.84E-06)	(2.9E-04)
Pupil - Teacher Ratio	7.6E-04	0.221	-0.011	-0.149
	(0.009)	(0.552)	(0.010)	(0.523)
% Masters or Higher	0.001*	0.073**	0.001*	0.092***
	(6.4E-04)	(0.040)	(6.5E-04)	(0.031)
Average Teacher Exp	-0.001	-0.188	0.001	-0.015
	(0.004)	(0.222)	(0.004)	(0.183)
Average Salary	-3.5E-07	1.69E-06	1.7E-06	7E-05
	(2.1E-06)	(1.3E-04)	(2.2E-06)	(1E-04)
Constant	2.891***	82.147***	2.567***	48.155***
	(0.189)	(12.629)	(0.196)	(10.788)
R-Squared	0.0485	0.0568	0.0443	0.0686
Observations	3,211	3,221	3,216	3,217

Notes: ***, **, * denote significance at 1%, 5%, and 10% respectively. Observations come from the Wisconsin DPI. Standard deviations are reported in parentheses. The sample is divided into the three pre-k categories: Community Approach, Traditional, and No Pre-K. No Pre-K is the reference group for school program type.

Table 5:
Multinomial Logit

	Community Approach	**Traditional**
	(1)	(2)
% FLE Total	0.033***	0.032***
	(0.007)	(0.007)
% Minority	0.009	-0.015
	(0.013)	(0.012)
% Total Attend Rate	0.033	-2E-04
	(0.084)	(0.031)
Cost Per Pupil	-2E-04*	1.6E-04**
	(1.1E-04)	(8.1E-05)
Pupil - Teacher Ratio	-0.021	0.214**
	(0.172)	(0.106)
% Masters or Higher	0.010	-0.018***
	(0.010)	(0.007)
Average Teacher Exp	-0.016	0.031
	(0.067)	(0.039)
Average Salary	5.7E-06	-3.7E-05
	(3.8E-05)	(2.3E-05)
Constant	-2.600	-1.601
	(8.505)	(3.473)
R-Squared	0.1350	0.1350
Observations	3,226	3,226

Notes: ***, **, * denote significance at 1%, 5%, and 10% respectively. Observations come from the Wisconsin DPI. Standard deviations are reported in parentheses. The sample is divided into the three potential pre-k categories: Community Approach, Traditional, and No Pre-K. No Pre-K is the reference group for school program type.