The Relationship between District Capital Outlay Revenue Inequities and Adoption of the Four Day Instructional Week, Yearly Instructional Time, and Class Size in Oklahoma

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Previous studies have demonstrated that capital outlay funding across districts in the state of Oklahoma has been highly inequitable for many years (Maiden & Stearns, 2007: Hime & Maiden, 2019). These inequities are the natural result of capital outlay being exclusively funded by local districts, absent equalization aid from the state. Given the lack of state aid, wealthier districts are more readily able to raise capital outlay revenues than less wealthy districts because revenues are based on local taxable property wealth. Hime and Maiden (2019) also determined that these capital outlay inequities affected general operations equity, finding that districts that raise higher amounts of capital outlay revenues generally paid higher teacher salaries than other districts, a result of what they labeled as crossover effects. They demonstrated the impact that one restricted revenue source can have on another when a certain amount of crossover funding is possible and impact crossover inequity may have on educational outcomes (Hime & Maiden, 2019).

The purpose of this quantitative, causal comparative study was to determine whether capital outlay inequities are related to inequities in other elements of general operations beyond teacher salaries, and to examine the extent to which capital outlay inequities compel poorer districts to more readily adopt cost savings measures during funding austerity. The study also assessed the extent to which these relationships were more pronounced in rural districts and in districts serving higher proportions of students from economically disadvantaged families.

Background

The state of Oklahoma attempts to enhance horizontal and vertical equity using weighted student formulae to distribute state aid for general operations (outside capital outlay). Horizontal equity is addressed using the equalization formulae, while vertical equity is addressed through student weighting within the formulae (OSDE, 2017). Previous studies have documented the degree of fiscal equity in the general funding system (Deering & Maiden, 1999; EdBuild, 2018; Hancock, 2008; Maiden, 2019; Maiden, 1998; Maiden & Stearns, 2007).

However, Oklahoma has no method to equalize capital funding (ASCE, 2017; TLC, 2006). The state endeavored to address inequity in capital funding in 1984 through the passage of Oklahoma State Question 578, which established the Public Common School Building Equalization Fund (Haxton, 2009). Under the provisions of the statute, the Oklahoma State Board of Education (OSBE) can allocate monies to LEAs for capital improvements through an equalization formula (2009). The practical reality is that no money has ever been deposited into the fund. (p. 58). The result is substantial inequities in capital outlay funding among districts across the state (Maiden & Stearns, 2007; Hime & Maiden, 2019).

Complicating fiscal equity was the effect of the Great Recession of the 2010s. Oklahoma is among 12 states with lower school funding than before the Great Recession (Leachmen, Masterson & Figueroa, 2017) Oklahoma reduced state education funding during the Great Recession, which coupled with increased challenges in raising local ad valorem revenue during this period of time led to financial stress of local districts.

These inequities are exacerbated in rural districts across the state. Rural inequities are a national problem, given the added expense of providing comparable education services in areas with small populations and in isolated rural areas (Maiden, 2003). One-third of students in U.S. rural communities come from families living in poverty (Maiden, 2003). The tax base in these rural areas is often composed of lower-value farmland and other types of property that provides inadequate revenue to meet the capital needs of districts. As Johnson and Maiden (2010) indicated, "[R]ural schools face funding issues metropolitan areas do not. Many of these funding issues deal directly with capital outlay and the inability of rural districts to renovate, remodel, equip, and build facilities" (p.2). The byproduct of rural poverty is an inadequacy of infrastructure to support emerging educational technology, deferred maintenance, and the lack of capacity to meet the needs of growing enrollment (Maiden, 2003).

Approximately 78% of districts in Oklahoma considered rural (NCES, 2004), while 80% of Oklahoma high schools have average daily memberships (ADM) of less than 500 students and 29% have ADM below 100 students (Oklahoma Secondary School Activities Association, 2017). Property values are generally lower in rural areas of the state, and these districts tend to have relatively large percentages of students from lower socioeconomic circumstances (Jimerson, 2005; Johnson & Maiden, 2010).

Small, rural districts are especially vulnerable to inequity in capital funding. When windmill farms, oil wells, oil refineries, or power plants move into rural areas, gains and losses are created in capital funding. For districts adding revenue, budgeting flexibility is gained. This flexibility diminishes the impact of funding cuts in state aid. Specifically, it may diminish the necessity of a four-day week, a reduction in overall instructional time, or increased teacher-student ratios. For districts with low capital outlay, the loss of budgeting flexibility results in deferred maintenance to facilities, lack of upgrades to technology, and cuts to personnel.

The current study endeavored to ascertain the extent to which inequities in capital outlay capacity in Oklahoma public schools were related to certain financial outcomes, particularly cost-saving measure implemented during reductions in state aid from 2014 through 2018. Specifically, the study examined the relationship between district ability to raise capital outlay revenue and three cost cutting outcomes: Adoption of the four-day instructional week, district average class time in minutes, and average district class size.

The instructional time requirement for the years of the study were 1,050 instructional hours in a year plus an additional 30 hours of professional development, for a total requirement of 1,080 hours (OSDE, 2017). Local district boards of education can configure instructional time into four-day instructional weeks. Increasing numbers of Oklahoma school districts have transitioned to a four-day week over the past several years. By 2017, 91 (slightly less than 20% of all districts) followed the schedule. (Holder 2017). National studies have indicated that most adopt the four-day week to save money (Anderson and Walker, 2015; Colorado Department of Education; 2016; Domier, 2009; Hewitt & Denny, 2011; Lefly & Penn, 2011: Plucker, Cierniak, & Chamberlin, 2012). However, the Education Commission of the States (ECS) estimates maximum savings at 5.45%, and most districts witness savings closer to 2% by adopting the calendar (2012). The current study focused the impact of capital outlay capacity on cost saving measures, which included adoption of the four-day week, that existed during the years of the study. The focus is on the need to pursue these cost savings measures, irrespective of whether they continue as a current option. The availability of the option to adopt the four day week and the viability of instructional time versus number of instructional days, specifically, is subject to change.

Use of the four-day instructional week is certainly not devoid of controversy centering around quality of instruction, and many districts have chosen to reduce school days without fully converting to a four-day week. Reduction of days provided savings to the district in transportations and support salaries (Anderson & Walker, 2015). Clearly, reductions in instructional time is problematic in that instructional time has been related to increased student achievement in the literature (Goodman, 2014; Hansen, 2011; Marcotte & Hemelt, 2008; Patall, Cooper & Allen, 2010).

The need for budget reductions coupled with the lack of qualified teachers may be equating to larger class sizes for Oklahoma students. In 1990, Oklahoma enacted legislation establishing mandatory class sizes for students in public schools. However, in 2002, the legislature exempted districts from the mandates because of funding reductions (Fine, 2018). Alarmingly, average class sizes have been climbing in the state since this time (see Figure 1). Smaller student-to-teacher ratios have been positively related to increase student achievement and reduced discipline incidents in the classroom in the literature (Finn & Achilles, 1999; Schneider, 2002).

Figure 1: Gap between Teacher and Student Counts in Oklahoma, 2010-2019

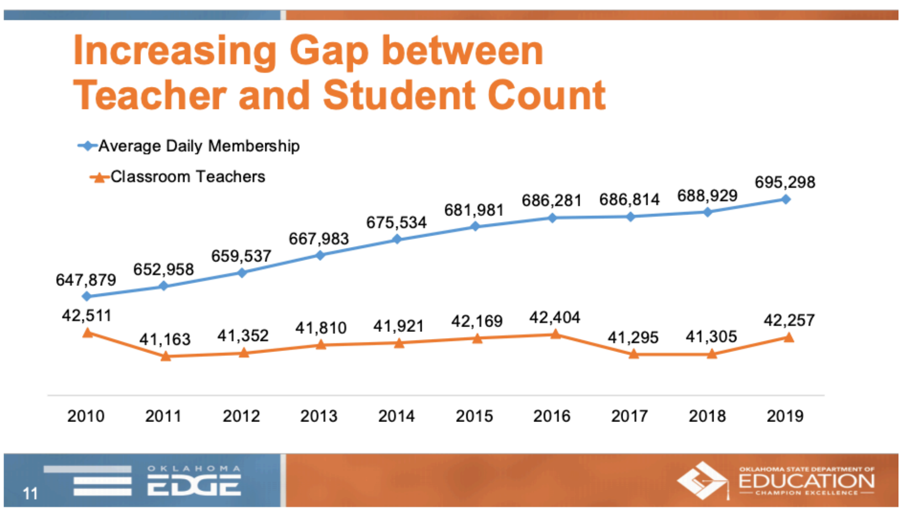


Figure **Error! No text of specified style in document.**.1*: Increasing Gap Between Teacher and Student Count (OSDE, 2019)*

Context

General operations funding in Oklahoma is based on a two-tiered equalization formula coupled with a transportation supplement. Student counts are based on average daily membership (ADM), which is weighted based on grade level, special education and a district isolation/small school weight. The result is weighted average daily membership (WADM), resulting in a degree of vertical equity. The foundation program includes a legislatively determined foundation amount from which each district's contribution is subtracted (the local contribution is based on levies from 15 mill ad valorem plus several chargeable income factors). The second-tier formula, a modified guaranteed yield entitled salary incentive aid, includes a guaranteed amount per WADM from which local yield from 20 mills ad valorem taxes is subtracted for each district. Thus, both formulae are equity based.

However, no state capital outlay funding is provided to local districts in Oklahoma. Local districts are eligible for capital outlay needs mostly from two sources. The first is a building fund levy equal to 5 mills is assessed on real and personal property within a district (OSDE, 2013). The building fund may be used by a school district for a variety of capital needs, from building construction, maintenance and repair to certain technology needs. All revenues are local, with no state aid being available.

The inequity in Oklahoma's capital funding may best be explained using an example. A district with a net valuation of $430 million would equate to $2 million for capital outlay (OCAS, 2017). Conversely, a district with a net valuation of only $67 million generate $335 thousand to support capital outlay (OCAS, 2017). In this example to wealthier district yield six times more than the less wealthy district. Assuming the student count is roughly equivalent, the inherent inequities are huge.

The second source of capital outlay revenue available for Oklahoma districts is through bonding. The passage of a bond issue allows local districts to become indebted when approved by a super majority of 60% of registered voters (OSDE, 2013). The debt is serviced through the use of a sinking fund levy assessed by the respective county on the real and personal property within a district (2013). Bonds are the only additional method to gain funding for construction, and a district may not bond beyond 10% of the district's valuation (Haxton, 2009; OSDE, 2013). Therefore, Oklahoma school district's bonding capacity is directly related to the district's capacity to raise capital outlay. Furthermore, bond revenue is restrictive, meaning only what is in the bond issue's legal description may be funded with bond revenue (2009: 2013). As with the building fund, local district bond levies are not matched by the state, and naturally occurring inequities among districts result. These inequities are based both on local taxable wealth and on the ability of districts to gain the requisite 60% voter approval.

Design and Results

Overview of the multilevel analyses

We performed a series of two-level multilevel regression analyses in order to test whether per-pupil valuation (PPV), poverty rate, and district identification as being rural (versus non-rural) are significant predictors of class size, instructional hours, and the probability of a district adopting a four-day week during the observation period (2014-2018) in our study. Most of the original variables, including the dependent variables, were measured yearly during the five-year observation period. As such, the yearly (i.e., within-district) measurements of class size, instructional hours, or four-day week served as the Level 1 (repeated) outcome in the models we tested. Although per-pupil valuation (PPV) and poverty rate were both measured yearly during the observation window, we incorporated these variables as both time-varying (i.e., within district) and time-invariant (i.e., between district) predictors of the Level 1 outcome variable in each model. Time-invariant versions of PPV and poverty rate were constructed by averaging values across the five-year window for each district. These predictors were included in our models as Level 2 predictors. The time-varying (within-district) versions of these variables were centered at the district means (referred to as 'centering within cluster' by Enders and Tofihi

(2007) prior to including them in our models as Level 1 predictors. The result of including our (CWC) within-district and between-district versions of the predictors is a within-between, or hybrid, model (Bell, Fairbrother, & Jones 2018) whereby the total association between PPV and poverty rate and our outcomes were broken down into additive within- and between-district associations (see Enders & Tofihi, 2007; see also Hamaker & Muthén, 2019). 'Rural' – an indicator variable coded 0=non-rural and 1=rural – was the lone district-level characteristic that was directly measured in our study. As such, it was included in our models as a Level 2 predictor.

For each analysis involving a given repeated outcome variable, we began by estimating an intercept-only model. This served as baseline with which to compare subsequent models incorporating our predictor variables. Next, we tested a growth curve model to explore whether there was any evidence of trending on the repeated outcome measure over the observation period. For this model, time indicators (i.e., Linear & Quadratic) were included in the model to test whether any observed changes over time on a repeated outcome followed a linear or quadratic trend. Linear (time) was coded 0, 1, 2, 3, and 4 (see discussion on coding in Heck, Thomas, & Tabata, 2014). The Quadratic component was computed as the square of Linear (time). For our final model al model, we included the full set of within- (i.e., time-varying) and between- (i.e., time invariant) district predictors of the repeated outcome.

All models were tested assuming an autoregressive (AR1) repeated covariance type at Level 1. Models incorporating either class size or instructional hours as the repeated, Level 1 outcome were tested using linear mixed modeling. Models incorporating four-day week (coded 0=no, 1=yes) were tested using generalized mixed modeling based on the binomial distribution and the log-link function. All analyses were performed using IBM SPSS Version 26.

Predicting class size

Our test of the intercept-only model (Model 1) revealed evidence of significant variation across districts in average class sizes (see Table 1). Of note, the intraclass correlation coefficient (ICC) indicated that 69.4% of the variation in class size occurred at the between-district level. The fixed intercept parameter (β_{00} =14.69) indicated that the average class size across district and across time was 14.69 students. Model 2, containing only the growth curve parameters, suggested that class sizes exhibited positive linear growth over time. Of the Linear and Quadratic growth components, only the Linear growth parameter was statistically significant (β_{10} =.15, p=.003). Given our coding of the Linear variable, intercept in the model is interpreted as the grand mean (approximately 14.5) for class size across districts in 2014. We compared the fit of Model 1 to Model 2 using the Likelihood Ratio test and Akaike's Information Criterion (AIC). The likelihood ratio chi-square test indicated that the inclusion of the time indicators resulted in a significant [LR $\chi^2(2)$=21.388, p<.001] improvement in model fit relative to the intercept-only model. The fact that the AIC for Model 2 (AIC = 8799.674742) was smaller than that for Model 1 (AIC = 8817.063056) provided additional support for this conclusion.

For our final analysis, we added our Level 1 and Level 2 predictors of class size. Since the Quadratic predictor was not statistically significant in Model 2, it was not included in the final model in the interest of parsimony. A comparison of Models 2 and 3 using the AIC (which is particularly useful with non-nested models, which was the case when we removed the Quadratic term) revealed that the fit of Model 3 (AIC = 8434.962608) was clearly better than that for Model 2 (AIC = 8799.674742). In Model 3, within-district variation in poverty (i.e., Poverty.cwc) did not emerge as a significant predictor. However, the Level 2 between-district poverty (Poverty.mean) variable was negative and statistically significant (β_{01} =.15, p < .001).

Both within-district ($\beta_{40} = -0.000007$, p < .001) and between-district ($\beta_{02} = -0.000021$, p < .001) per-pupil valuation (PPV) were negative and statistically significant predictors of class size. Finally, the Level 2 predictor 'Rural' was a negative and significant ($\beta_{03} = -1.99531$, p < .001) predictor of class size. Altogether the results indicate that higher poverty districts or rural districts tended to report lower class sizes. Nevertheless, districts with higher per pupil valuation overall or within a given year were also predicted to have lower class sizes.

Predicting instructional hours

The intercept-only model (i.e., Model 1; see Table 2) revealed significant variation (p < .001) across districts in instructional hours provided (as averaged over the five-year observation period). Moreover, the ICC indicated that approximately 33.3% of the variation in instructional hours appeared to occur between districts. Model 2, containing the growth components, fit the data significantly better [LR $\chi^2(2)$=88.787, p<.001] than Model 1. Unlike class size, the Quadratic growth component was statistically significant (β_{20} =-1.455, p<.001), suggesting a curvilinear rate of change over time with respect to instructional hours. Figure 1 contains a plot of the conditional means of instructional hours across time. As can be seen in the figure, instructional hours exhibited increasing rates of decline from 2015 through 2018.

Table 1: Unstandardized regression slopes, standard errors, and significance test results for models predicting class size

	Model 1 / Intercept-only	Model 2	Model 3
Intercept, β_{00}	14.691483*** (0.109616)	14.496808*** (0.117232)	19.553446*** (0.403228)
Linear (L1), β_{10}		0.150331 ^{ns} (0.051194)	0.119571*** (0.020252)
Quadratic (L1), β_{20}		-0.015185*** (0.011803)	
Poverty.cwc (L1), β_{30}			-0.225101 (0.249079)
PerPupilVal.cwc (L1), β_{40}			-0.000007*** (0.000001)
Poverty.mean (L2), β_{01}			-4.511762*** (0.548541)
PerPupilVal.mean (L2), β_{02}			-0.000021*** (0.000001)
Rural (L2), β_{03}			-1.199531*** (0.192170)
Level 1 residual variance	2.189477*** (0.244758)	2.032712*** (0.212883)	1.868158*** (0.180260)
AR1(rho)	0.687511*** (0.035699)	0.439962*** (0.035911)	0.641435*** (0.035511)
Level 2 intercept variance	4.958836*** (0.440095)	770.838899*** (0.426165)	2.611753*** (0.270712)
Deviance	8809.063056	8787.674742	8434.962608
AIC	8817.063056	8799.674742	8454.962608
Df	4	6	10
ICC	.694	.997	.582

Note: ***p≤.001, **p≤.01, p≤.05, ^{a}p≤.05 (one-tailed), ^{ns}non-significant. Standard errors are shown in parentheses.

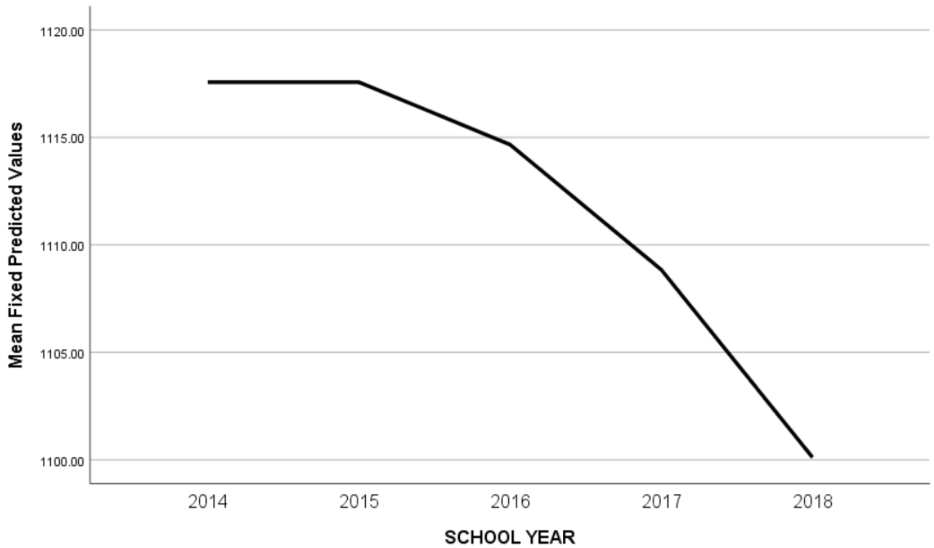
Model 3 containing the full slate of predictors represented a clear improvement in fit relative to Model 2 [[LR $\chi^2(5)$=103.580, p<.001; AIC Model 2 = 25210.489115, AIC Model 3 = 25116]. Apart from the Quadratic trend component (β_{20} =-1.454281, p<.001), only district-level mean for per-pupil valuation (PPV) (β_{02} =0.000068, p=.006) and district-level poverty (β_{01} =-17.167919, p=.041, one-tailed) emerged as significant predictors the model. These findings suggest that those districts with greater average PPV or lower average poverty rate tend to have higher average instructional hours.

Table 2: Unstandardized regression slopes, standard errors, and significance test results for models predicting instructional hours

	Model 1 / Intercept-only	Model 2	Model 3
Intercept, β_{00}	1110.932101*** (1.518148)	1117.569788*** (1.879987)	1128.007967*** (7.301681)
Linear (L1), β_{10}		1.456617^{ns} (1.440737)	1.450893^{ns} (1.450909)
Quadratic (L1), β_{20}		-1.455104*** (0.338805)	-1.454281*** (0.341013)
Poverty.cwc (L1), β_{30}			1.726554^{ns} (7.224808)
PerPupilVal.cwc (L1), β_{40}			-0.000007^{ns} (0.000030)
Poverty.mean (L2), β_{01}			-17.167919^{a} (9.854270)
PerPupilVal.mean (L2), β_{02}			0.000068** (0.000024)
Rural (L2), β_{03}			-4.121148 ^{ns} (3.540778)
Level 1 residual variance	1264.614454*** (86.417365)	1067.837334*** (63.379523)	1072.211611*** (64.109298)
AR1(rho)	0.517404*** (0.033867)	0.439805*** (0.034305)	0.440654*** (0.034521)
Level 2 intercept variance	632.352442*** (98.586055)	771.027475*** (86.756881)	740.329860*** (85.887929)
Deviance	25286.786654	25198.489115	25094.420307
AIC	25294.786654	25210.489115	25116.420307
Df	4	6	11
ICC	.333	.419	.408

Note: ***p≤.001, **p≤.01, p≤.05, ^{a}p≤.05 (one-tailed), ^{ns}non-significant. Standard errors are shown in parentheses.

Figure 1: Conditional means (based on Model 2) of instructional hours plotted against school year



Predicting four-day week

Our final set of analyses involved the use of multilevel binary logistic regression with ‘four-day week’ entered as the binary (repeated) outcome variable. Unfortunately, because our analyses rely on quasi-likelihood estimation methods that render model comparisons based on model deviances (-2LL) ‘tenuous’ (Heck, Thomas, & Tabata, 2012) we chose not to utilize the LR test or AIC when describing the models in this section. Thus, the focus of our analyses was on estimating and interpreting model parameters without explicitly making comparisons between models. Our intercept-only model (i.e., Model 1) failed to converge, as the intercept variance was effectively zero. Therefore, we proceeded to test our growth curve model (Model 2) and our model containing the full set of predictors (Model 3). Table 3 below contains results from Models 2 and 3.

For Model 2, both the Linear and Quadratic growth parameters were statistically significant. Given that unstandardized regression coefficients reflect the relationship between time and predicted logits (or log odds, which represents the non-linear transformation of the probabilities associated with group membership), these coefficients are very difficult to interpret for the reader in a manner that might be meaningful. Nevertheless, we can see that the odds ratio for the Linear component is greater than 1, indicating that the odds of a school district reporting having four-day weeks were increasing over time. Figure 2 contains a plot of the average conditional probability of a district having a four-day week by year (see Figure 2). In general, we see yearly increases in the probability of a district adopting a four-day week throughout the study period from 2014 to 2018.

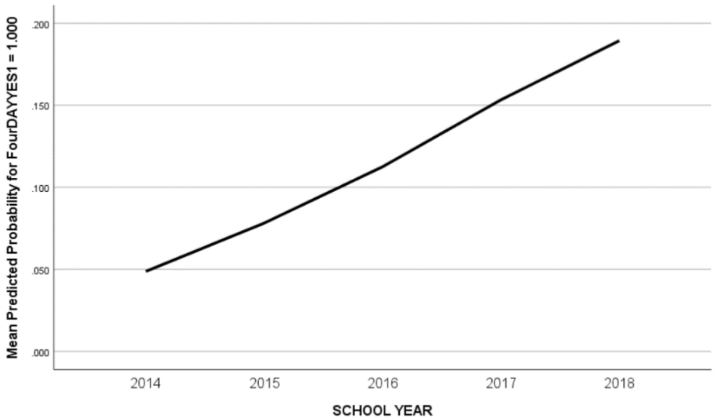
For Model 3, both the linear and quadratic growth components remained significant after incorporation of our focal predictors. The Level 1 (β_{20} =1.771563, p=.037) and Level 2 (β_{01} =3.892549, p=.003) poverty predictors were both positive and significant in the model. These results indicated that districts with greater levels of poverty were more likely to adopt a four-day week than districts experiencing a lower rate of poverty. Neither within- nor between-district per-pupil valuation were significant predictors in the model. The Level 2 predictor, 'Rural,' emerged as a positive and significant (β_{03} =2.141386, p<.001) predictor of the likelihood of a district adopting a four-day week. In effect, this indicates that rural districts were more likely to adopt a four-day week than non-rural districts.

Table 3: Unstandardized regression slopes, standard errors, and significance test results for models predicting likelihood of adoption of a four-day week

	Model 2	Model 3
Intercept, β_{00}	-6.424177*** (0.279781) / OR = 0.001622	-10.808782*** (1.075650) / OR = 0.000020
Linear (L1), β_{10}	1.436797 *** (0.184280) / OR = 4.207199	1.546285*** (0.197729) / OR = 4.693997
Quadratic (L1), β_{20}	-0.096232* (0.038040) / OR = 0.908254	-0.108318** (0.041005) / OR = 0.897343
Poverty.cwc (L1), β_{30}		1.771563* (0.848359) / OR = 5.880039
PerPupilVal.cwc (L1), β_{40}		-0.000004^{ns} (0.000006) / OR = 0.999996
Poverty.mean (L2), β_{01}		3.892549** (1.314173) / OR = 49.035702
PerPupilVal.mean (L2), β_{02}		-0.000004 ^{ns} (0.000003) / OR = 0.999996
Rural (L2), β_{03}		2.141386 *** (0.504565) / OR = 8.511228
Level 1 residual variance	0.340473*** (0.013708)	0.337784 *** (0.012678)
AR1(rho)	0.312082*** (0.031890)	0.258888 *** (0.032239)
Level 2 intercept variance	9.691874*** (0.886161)	10.275728 *** (0.966291)

Note: ***p≤.001, **p≤.01, p≤.05, ^{a}p≤.05 (one-tailed), ^{ns}non-significant. Standard errors are shown in parentheses.

Figure 2: Probability four-day week by year



Discussion

Hime and Maiden (2019) demonstrated a disequalizing effect on state aid in operational funds due to "crossover funding" whereby property-wealthy districts were utilizing copious capital revenue to supplement operational funding. The current study sought to ascertain whether a relationship also exists between capital outlay inequities and other general fund resources, particularly those related to local district cost-saving measures to include alternate school calendars, reductions in instructional time, or increased class sizes. Ideally, with an equitable state aid formula, cuts in state aid should equally affect all districts and no relationship should exist between these cost-saving measures and district wealth.

The connection between time and money is important because during the years included in the current study, districts have slowly reduced instructional days to garner savings, much akin to implementation of the four-day instructional week. Doing so may have avoided the criticism of implementation of the four-day week while concomitantly reaping the benefit of cost savings in support salaries, transportation, and substitute teachers. However, equivalent instructional time rearranged into a four-day week does not have the same consequences for student achievement

(Anderson and Walker, 2015; Colorado Department of Education; 2016, Domier, 2009; Hewitt & Denny, 2011; Lefly & Penn, 2011) as does the decrease in overall instructional time (Berliner, 1990; Fredrick & Walberg, 1980; Levine, 1989; Smith, 2000). The statistically significant inverse relationship between inequitable capital outlay capacity and instructional time found in the current study, combined with the overall trend of reductions in state aid, suggests many districts with modest capacity for capital outlay funding may be addressing budget shortfalls with decreases to instructional time. Inequitable capital outlay capacity created a disadvantage for those districts with lower assessed valuations. It is a troubling outcome, and more research is required to determine whether a trend is emerging.

The results for district adoption of a four-day instructional week were mixed. Between district differences in capital outlay capacity (as indicated by per pupil assessed valuation) did not significantly affect district adoption of the four-day week. Conversely, there was a direct and statistically significant relationship between percent district poverty (as indicated by district percent student eligibility for free and reduced lunch) and adoption of the four-day week. In other words, district wealth did not affect adoption of the four-day week, but the overall percent of poverty within the district was a significant predictor, evidence of a basic inequity. Additionally, districts serving rural communities were more likely to adopt the four-day week than other districts.

Capital outlay inequities between rural and non-rural districts has been documented in the literature (Johnson & Maiden, 2010; Maiden, 1998; Maiden & Stearns, 2007). The current study couples this inequity in capital outlay with the four-day instructional week. Rural districts tend to be smaller, have more students from lower socioeconomic circumstances, and have lower valuations. Intuitively, savings from transportation due to a four-day week could be increased in rural districts compared to non-rural districts. However, Oklahoma provides additional transportation funding for low density districts in the funding formula (EdBuild, 2018; OSDE, 2017); therefore, it cannot be simply a transportation advantage forcing the adoption of the alternative calendar.

The inverse relationship between capital outlay capacity and instructional time was evident in the results of the analysis. Clearly, districts with the least ability to generate capital funding (as indicated by per pupil valuation) were more likely to offer fewer hours of instruction to students. This relationship was curvilinear and significant, indicating that this relationship strengthened over time.

Further magnifying the inequity is the finding that district poverty rate was also inversely related to instructional time. Districts with a higher percentage of students qualifying for free and reduced lunch were more likely to offer fewer instructional hours to students than districts with fewer qualifying students. This relationship was also curvilinear and significant.

The statistically significant inverse relationship between capital outlay capacity and class size during the 5 years of the current study indicate a serious consequence of inequitable capital funding for Oklahoma students. Generally, students educated in Oklahoma districts with lower assessed valuations were faced with decreased access to their instructors because of larger class sizes. Like many states, Oklahoma has witnessed a trend in increasing class sizes, possibly explained by the teacher shortage in the state combined with significant reductions in state aid. The findings of current study suggest that these increases are related to district ability to raise capital outlay revenues.

The overall concern for increased class sizes arises from the reduced access to teachers because an effective teacher is a strong determinant of student achievement (Darling-Hammond, 2000; Ferguson, 1991; Harris & Sass, 2011; Owings, Kaplan, & Chappell, 2011; Rothstein, 2010). One of the primary goals of the *No Child Left Behind* law was to provide a “highly qualified teacher" to students, and the federal law mandated small class sizes as part of this goal (Harris & Sass, 2011, p. 1). Smaller class sizes, especially in the elementary grades, are related to increased achievement and decreases in undesirable student behaviors (2000). Furthermore, the positive effects of small classes increase in magnitude for minority and economically disadvantaged students.

Tennessee's Project STAR included a controlled, scientific experiment, and has become the exemplar for class size studies. One outcome of the four-year study was substantial improvements in early learning for students in class sizes of 13-17. The study yielded many benefits of small classes, including improvements in teaching conditions, student performance, student learning behaviors, discipline, and student retentions (Finn & Achilles, 1999, p. 98). The study also debunked the theory that effects were simply due to decreases in adult to student ratios because adding teacher aides to the classrooms did not produce similar benefits (1999).

The findings of the current study suggest class size may be adversely affected by inequitable capital funding. This is not surprising given the majority of a district's budget is composed of teacher salaries, and balancing its budget following repeated reductions in state aid often requires reduction of teaching force. Only a small percentage of savings comes from either reducing instructional time or implementing a four-day school week because the savings from those reductions are derived from support wages. These conclusions are consistent with Hime and Maiden's (2019) findings that school districts with greater access to capital improvement revenue are better able to support higher teacher salaries. The current study also associated wealthier districts with an overarching capacity to hire greater numbers of teachers and thus, offer decreased class sizes.

The statistically significant inverse relationship between rural schools and class size may seem counterintuitive; however, rural schools must offer required courses, irrespective of district enrollment. Every elementary school must have a first grade and high schools must offer Algebra I, English, and U.S. History, regardless of the number of students in a class. Oklahoma is one of 33 states that provides additional resources for sparse districts or small schools, either directly through the state aid formula or through transportation aid (EdBuild, 2018). School funding formulas must account for the diseconomies of scale in small, rural schools in order to provide equal educational opportunities for students (Bowles & Bosworth, 2002). Therefore, it is likely the additional funding created the inverse effect. Typically, the consolidation argument has traditionally centered around administration costs; however, the findings of the current study suggest that class size may be a significant determinant in the diseconomy of scale additional costs faced by rural and small school districts.

The relationship between poverty percentage and class size was also negative, indicating that an increase in district poverty percentage was associated with lower class sizes. Yet the finding does make sense in that Oklahoma receives over $150 million in Title I funding for students in poverty (OSDE, 2019), and the Oklahoma state aid formula creates greater equity for districts where poverty is concentrated through its funding formula. The state formula provides additional resources for students from low-income households by weighting them as 1.25 in the state aid formula. These additional state and federal resources may explain the inverse relationship between district percent poverty and class size during the years of the study.

Oklahoma witnessed the greatest cuts to education of any state from 2008-2015 (Leachman, Albares, Masterson & Wallace, 2016). After several years of cuts to state aid, in 2016 and 2017, there were multiple general fund revenue failures, resulting in deep cuts to the funding formula for school districts. By 2018, inequities were overtly exposed, especially for districts lacking the advantage of property wealth that provided access to the flexibility of crossover funding (Hime & Maiden, 2018). The duress of multiple-year budget reductions combined with the lack of capital outlay crossover funding flexibility in lower-wealth districts created a situation where superintendents from property-poor districts may have been willing to seek drastic cost-saving measures to balance their operational budgets, as documented by the statistical relationships found. A follow up study in subsequent years is warranted to examine whether the trend continues or resolves as school funding recovers.

Importantly, a more consistent result of the study was the statistically significant inverse relationship found between the inequities in capital funding and class size. The overall increase in class size occurred because there were less classroom teachers in a district. Traditionally, teachers are paid from operational funding, which is supported from state aid revenue, not capital outlay. There is no provision to pay teachers from capital outlay in Oklahoma. Personnel is approximately 85% of a school district's operational budget and the most significant budget savings are found in eliminating teachers. Cost-saving measures of reducing instructional time or adopting a four-day week will not provide the same percentage of savings as eliminating teachers. Even though inequity was obviously exposed in capital outlay capacity during the period under study due to the budget reduction climate, it is deeply troubling that there is a possibility the inequity in capital outlay may be impacting school districts' operational funding to the extent that district wealth is statistically associated with class size.

Unintentionally, the Oklahoma statute that provides flexibility to use capital revenue for certain operational expenses has created a disequalizing effect on elements of general education funding (Hime and Maiden, 2017). Though formula-based equity has been well documented, inequity in capital funding has largely been ignored, and there are definitive consequences of these inequities. Lack of equity in schools has been shown to depress economic growth because underutilization of human potential is costly (McKinsey and Company, 2009; Baker, Sciarra, & Farris, 2012). Furthermore, several studies have shown equity increases with state funding of capital outlay, often referred to as “flat funding” or “lump-sum aid” (Duncombe & Wang, 2009; Maiocco, 2004; Odden & Picus, 2000; Sielke, 2001; Thompson, 1985), and Oklahoma has a constitutional fund for providing state aid for capital revenue, the State Public Common School Building Equalization Fund that has never been funded.

The results of this study suggest several follow up studies about Oklahoma education funding. Clearly, future research might examine other potential effects of capital outlay inequities on other resources in addition to instructional time and class size, in the context of crossover funding. The current study uncovered a trend of Oklahoma school districts reducing instructional time; additional research is necessary to determine if there is a byproduct of the Great Recession or an emerging trend. Finally, a study into class sizes in small, rural schools is warranted to determine if the diseconomy of scale and the associated costs necessity to offer required classes could surpass the traditional argument of administrative costs being the primary concern for consolidation of small districts.

Recommendations for Policy Makers

Despite multiple studies demonstrating equity increases when funding is collected and dispersed at the state-level (ASCE, 2017; 21st Century School Fund, National Council on School Facilities, The Center for Green Schools, 2016; Thompson, 1985; TLC, 2006), Oklahoma remains one of four states solely funding capital improvements at the local level (2006). In Oklahoma, property wealth is the sole predictor of capital outlay even though the practice has been demonstrated to disadvantage students in low-wealth districts. Oklahoma has perhaps avoided school funding lawsuits due to its equitable state funding formula (Deering & Maiden 1999); however, Hime and Maiden (2017) demonstrated inequitable capital funding has a disequalizing effect on equitably distributed state aid and has impacted a district’s ability to pay teacher salaries (2017). This study observed statistically significant relationships between inequitable capital outlay capacity and decreased instructional time as well as increased class sizes. Therefore, the recommendations for policy makers are equivalent to those posed by Hime and Maiden (2017):

1) We urge the Oklahoma Legislature to appropriate money to support the State Public Common School Building Equalization Fund (OK Const. art X sec 32). Capital outlay funding in the absence of state aid had been demonstrated to be inequitable (Hime and Maiden, 2017; Maiden and Stearns, 2007), and these inequities affect current operations (instructional time, class size and teacher salaries as determined by Hime and Maiden [2017]) due to the use of crossover funding. State funding is necessary to reduce these interdistrict imbalances. We realize that the state has faced consecutive years of declining revenues to support education and other critical state services, and that finding funds to appropriate to the Capital Fund may be a daunting task given current economic conditions. However, the Equalization Fund has historically not been supported irrespective of the state of the economy. Funding it is long overdue (Hime and Maiden, 2019).
2) We recommend the development of a capital outlay funding formula to disperse the funding generated through the State Public Common School Building Equalization Fund. A funding formula that recognizes naturally occurring fiscal abilities among local districts is warranted in order to help ensure Oklahoma school children are treated fairly (Hime and Maiden, 2019).
3) Policy makers should commission a study dealing the fiscal *adequacy* of Oklahoma capital funding in education. Though we believe the current study is sufficient evidence to support the previous two recommendations, we believe a richer understanding of the fiscal needs of school districts would help guide the development of a capital outlay funding formula in the short term, and would guide the Legislature in appropriating funds to provide sustainable

support the State Public Common School Building Equalization Fund. The nearly 700,000 children served in Oklahoma's schools deserve no less (Hime and Maiden, 2019).

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