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ABSTRACT

This study examined the impact of the Lighthouse program, a school-based, after-school remediation program in the Chicago Public Schools, on student academic achievement. The Lighthouse program included an extra hour of instructional time and an hour of recreational time. Between the two activities, students received a healthy late afternoon meal. Study data came from 2001 surveys of principals, teachers, and students at 491 elementary schools and from student test scores. Results indicated that between 2000 and 2001, Lighthouse students made 1-month gains in reading and math over non-Lighthouse students. Lighthouse students in predominantly African American schools were performing better in reading than their counterparts in schools that were not predominantly African American. Lighthouse students in high-poverty schools were doing much better than their counterparts in schools without high poverty percentages. Lighthouse students in high-poverty schools were least likely to be taught by their regular school day teachers, whereas, in predominantly minority schools, Lighthouse students were likely to have the same teacher from the regular school day. Predominantly African American and low-normed schools were more likely to extend the school day and/or serve more students. (Contains 29 references.) (SM)

When Time Matters:
Examining the Impact and Distribution of Extra Instructional Time

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When Time Matters: Examining the Impact and Distribution of Extra Instructional Time

Lighthouse is a school-based, after-school remediation program that has been in existence in Chicago since 1996. On the surface, this program appears to be an answer to several concerns such as parental need for after-school care, additional learning time for low performing students, supervised recreational time, and an extra meal for students who may otherwise not have the opportunity. However, Lighthouse has a more complex role in the daily experiences of students in the Chicago Public Schools (CPS). In 1996, CPS ended social promotion by requiring students in the third, sixth, and eighth grades to meet district-wide test score requirements or risk retention. While high stakes accountability measures have been heavily criticized (Hauser, 1999), ending social promotion in Chicago has provided students at-risk of missing the test score cut-off with extra instructional time both during the summer (Summer Bridge) and after-school (Lighthouse). This study is not only concerned with the impact of *Lighthouse* on student test performance, but also *Lighthouse* as an instructional resource; and how, if at all, this resource varies

between schools. While Lighthouse is meant to function as an "equalizer" by providing resources that only low performing students receive, the fear is that Lighthouse could also mirror the manner in which resources are already unequally distributed because, ultimately, Lighthouse is tied to the resources of the school.

The Lighthouse Program evolved from a corporate-sponsored initiative to extend the school day, which was successful in helping 38 out of the 40-targeted schools to improve their test scores (Smith et al., 2001). With the end of social promotion in 1996, CPS adopted this format and invited schools to apply for Lighthouse funds. In 1997, CPS spent approximately 14 million dollars on Lighthouse with additional monies from private grants and the federal government, totaling approximately 21 million dollars (Williams, 1997). In this first full year of implementation, 147 schools received Lighthouse dollars, and, by 2001, approximately 363 schools were reportedly participating in the program (Smith et al., 2001).[1] In fact, higher-performing schools also found the program attractive and applied for funds in order to

[1] Poor reporting procedures prevent an actual count of which schools receive Lighthouse dollars and how many students actually participate each year.

provide more assistance to their students who were having academic difficulties (Williams, 1997).

For some principals, Lighthouse dollars allowed them to redirect the funds already being used for additional support services toward other programs in their school buildings. For instance, the principal at one elementary school had been using $50,000 of discretionary monies for after-school classes. However, with Lighthouse funds, this principal was able to use that $50,000 toward summer classes for the grades in which the district was not already providing summer classes (e.g., the Summer Bridge program is a summer program specifically focusing on 3rd, 6th, and 8th graders) (Williams, 1997). On the other hand, at another elementary school, the principal didn't have extra money for special programs. The teachers at this school were volunteering their time during the after-school hours. With Lighthouse funds, the principal was able to pay teachers for their time (Williams, 1997). Other principals noted the additional benefits of Lighthouse, which included supervised recreational time and additional meals for students in high poverty communities (Williams, 1997).

Lighthouse programs typically have two components, the extra hour of instructional time and an hour of recreational time,

although some schools opt out of the recreational time (Smith et al., 2001). Between the extra hour of instruction and recreation, a late-afternoon meal is provided to students, typically in the form of sandwiches, fruit, and milk (Williams, 1997). In general, principals offer the academic portion of Lighthouse 3-4 days per week, with more Lighthouse programming occurring in poorer performing schools (Smith et al., 2001). An entire year of Lighthouse at 3 hours of Lighthouse per week is 108 hours per year; and, an entire year of Lighthouse at 4 hours per week is 144 hours per year. Considering the 900 hours of instructional time per school year, which amounts to about 100 hours of instructional time per month, Lighthouse instructional time equates to approximately an extra month of instruction per year.[2]

Anecdotal evidence suggests that the program is effective. In 1997, district administrators noted that schools who had participated in the after-school program had improved student performance in reading and math, specifically 30 of the 40 Lighthouse schools had gains in reading and 39 of the 40 Lighthouse schools had gains in math (Williams, 1997). In

[2] A 1998 report on CPS instructional time noted that schools typically spent 500 hours per school year on actual instruction (Smith, 1998).

addition, over 60% of the schools that were on probation (defined as less than 20% of the students reading at or above national norms) were able to meet the requirements to be removed from the probation list (Williams, 1997). However, the first study of Lighthouse provides mixed results on Lighthouse's effectiveness. Smith et al. (2001) found positive effects for third grade students, in that, schools that served higher proportions of third grade students showed greater overall gains for the third grade students in those schools. However, these effects did not hold for sixth and eighth graders. This current study adds to previous research by blending student, teacher, and principal data on the Lighthouse academic hour while the first evaluation only paired principal survey data on their Lighthouse programs with student achievement scores.

Study Framework

The framework for this study incorporates literature on instructional time and after-school care, using the lens of opportunity-to-learn research. By couching these bodies of work in opportunity-to-learn research, issues of equity guide the discussion.

Opportunity-to-learn. The current state of school reform is embodied in several efforts across the county to improve student performance, particularly the academic performance of students in urban areas (see Bryk et al., 1998; Comer, 1993; Meier, 1995; Slavin et al., 1996). In several districts, standards and accountability measures have been implemented in order to spur improvements in academic outcomes. However, critics note the importance of giving students the academic supports they need before they are held responsible for meeting certain curricular or test score requirements (Porter, 1995).

Inequality in access to school resources has been an on-going debate, particularly since the Coleman Report, which revealed that neighborhood and peer relationships (versus school quality differences) were considered factors of the black-white achievement gap (Coleman et al., 1966). With neighborhoods and families being touted as the root of the black-white achievement gap, there were few appropriate steps to rectify these between-school inequalities. Instead, there was a greater focus on students' cultural backgrounds (Tozer et al., 1995). More contemporary research addresses between-school inequality, in that poor and minority students have unequal access to challenging courses and

curricula (Anyon, 1989; Gamoran, 1987; Hanson, 1990; Oakes, 1990); teachers with fewer degrees and certifications in math and science (Oakes, 1990); teachers with fewer years of experience (Darling-Hammon & Green, 1990); and teachers who score lower on certification exams (Ferguson, 1991).

The utility of high stakes accountability measures are often seen in this light, that is, how can students be punished for a poor education that is no fault of their own. In this framework, the Lighthouse program is in a precarious position because, while it serves as an opportunity for students to receive additional instructional time, it is also a programmatic component of the high stakes accountability system occurring in this district. And, while the district has made some strides in attracting and retaining staff, there are still some schools that are hard to staff with quality teachers and administrators (Bryk et al., 1988).

Learning Time. Beyond material school resources such as teacher quality, there should also be equal opportunity for adequate learning time. In the U.S., students typically spend less of their school hours on actual instruction than students in other countries, which is important because studies show that students who invest more time studying a particular subject tend to outperform their

peers who spend less time doing so (National Education Commission on Time and Learning, 1994; Smith, 1998). In Chicago, Smith (1998) found that students were spending less of the allotted instructional time being involved with academic activities. She noted that detractors from instructional time rested with teacher management issues, school-level activity schedules, and district testing schedules. For example, teachers typically spent substantial instructional time on instructional preparation activities (e.g., directions, getting books out, getting into groups). Further, schools scheduled special assemblies, cultural events, field trips, and science or book fairs, which subtracted time from learning.

In addition, Smith et al. (1998) found that, of the instructional time available in CPS, students in disadvantaged neighborhoods faced less challenging instructional opportunities. More specifically, the instruction occurring in high-poverty schools was not keeping pace with the grade-appropriate content students were expected to meet on the Iowa Test of Basic Skills (ITBS). Plus, there was little curricular coordination within and between grades whereas some students re-learned the same content and skills from grade to grade instead of learning new material. So, while research also suggests that additional learning time is

particularly beneficial, the types of skills taught during that time are especially important for achievement gains to take place. In this regard, after-school programming could have a different impact in different contexts.

After-school programs. To date, more children go home to empty houses than ever before. It is estimated that approximately 8 million children are responsible for their own care after school (U. S. Department of Education, 2000). This situation is problematic, particularly since children are more likely to be involved in unproductive and uncreative activities such as television watching, hanging out with friends, and getting into trouble (Chung, 2000; Fashola, 1998; U. S. Department of Education, 2000). In most communities, there is a limited supply of after-school recreational and cultural programs, particularly affordable programs; and, in rural and urban communities, available after-school programs meet less than one-third and one-fifth of the demand, respectively (U. S. Department of Education, 2000).

The research shows that the most effective after-school program components include regular-day school and after-school program coordination (with regard to academic objectives); quality staff; providing recreational time and nutritional meals; and family

and community involvement (Chung, 2000; Fashola, 1998; Schwendiman & Fager, 1999; U.S. Department of Education, 2000). Many after-school programs that meet these programming components report improvements in participants' behavior. In communities with 21st Century Learning Centers (community-based, after-school programs supported by the Clinton-Gore administration) there were reductions in local pregnancy rates, juvenile crime rates, drug and alcohol use, and school absenteeism (U.S. Department of Education, 2000).

The benefits of after-school programming are not only evident in improved student behavior, but also in improved academic performance. A longitudinal evaluation of LA's BEST program (a comprehensive intervention program designed to address educational, social, and students' interpersonal goals in Los Angeles, California) revealed that the frequency of participation and length of participation in the program were related to achievement gains in math, reading, and language arts (Huang et al., 2000). In fact, there were also indirect outcomes of program participation on student test performance, namely program participants had better attendance rates that were related to improved test scores (Huang et al., 2000). Posner and Vandell

(1994) also found that after-school program participants made achievement gains; specifically, low-income students, who participated in after-school programs, spent more time involved with academic and enrichment activities. Their involvement in these activities was related to improved test scores.

In sum, the literature suggests that additional learning time is beneficial, and after-school programs, when developed properly, can serve academic, social, and interpersonal needs. However, considering the inherent disparities in instructional quality in this school system, the question is whether Lighthouse has the propensity to increase gains across all schools.

Data

In Spring 2001, the Consortium on Chicago School Research launched its biennial survey of the Chicago Public Schools. Principals, teachers, and students were surveyed about various characteristics of their school environments. Of the 491 elementary schools in Chicago, 373 principals, 7,750 teachers, and 46,777 students completed the survey. Of these survey respondents, 215 principals had Lighthouse programs, 1650 teachers taught Lighthouse, and 12,579 students attended

Lighthouse during the 2000-01 school year. This survey data was also complemented by student test scores from the Iowa Test of Basic Skills (ITBS), which was administered district-wide in Spring 2001. The test scores used in this study are reported in grade equivalents (GE's), whereas a student who has a 7.0GE in reading is performing on the seventh grade level.

Measures. Rasch analysis is a technique that determines if survey respondents are answering individual survey items in a way that is consistent with the overall construct under examination. Unlike factor analysis, Rasch takes into account how an individual responds in relationship to how others responded (e.g., ease or difficulty of agreeing with the item) as well as how they respond in relationship to other items to which they've responded (e.g., are teachers' responses in sync with their responses to other survey items included in the measure). The Winsteps program was used to analyze the data (Linacre, 1999) (see Appendix for details about measure construction and reliabilities).

Time spent on test preparation measure. Teachers were asked to indicate the amount of time spent doing various activities during Lighthouse. This measure includes teacher responses to three survey items about teaching test taking skills, focusing on

topical content of tests, and doing practice tests. Teachers who did 'high test prep' spent 25% or more of their time on practice tests, teaching test taking skills, and focusing on the content of the ITBS. Teachers who did 'low test prep' spent less than 10% of their time on practice tests, but 10-25% of their time on ITBS content and test taking skills.

Level of remediation measure. This measure also includes teacher response to the amount of time spent doing various activities during the Lighthouse hour. This measure includes five items that assess the degree of remediation occurring with each teacher such as the amount of time spent reinforcing reading and math skills. Teachers coded as 'remediation plus' spent more than 50% of their time helping students catch up on skills in which students were deficient, 10-25% of their time on reinforcing skills learned during the school day, and fewer than 10% of the time spent on homework, continuing the lessons from the regular school day, and doing enrichment activities such as writing workshops, book talks, and projects. Teachers coded as 'remediation basic' spent 25-50% of their time on helping students catch up on skills in which students were deficient, 10-25% of their time reinforcing skills learned during the school day, and no time on homework,

continuing lessons from the school day, and doing enrichment activities.

Other outcome variables are *small class size* (15 Lighthouse students or less) and *same students during Lighthouse* that is whether teachers taught their same students from their regular day classrooms during Lighthouse.

Analytical Strategy

This paper examines the effect of Lighthouse participation on student test gains in reading and mathematics. This paper also examines the extent to which Lighthouse instructional characteristics (e.g., high test prep, low test prep, remediation plus, remediation basic) and organizational features (e.g., class size, same students during Lighthouse) vary across Lighthouse programs. In order to adjust for the nested effects of school organizations, the data were analyzed with hierarchical linear modeling (HLM).

Achievement model. The first question guiding this study is whether Lighthouse participation is related to student performance. Using HLM statistical software (Raudenbush et al., 2000), a two level HLM model will be used to examine the effects of

Lighthouse participation on student gains in reading and mathematics. An initial ANOVA indicated that the between-school difference in student performance in negligible, which is understandable since most students should gain about a year's worth of instruction per year. The ANOVA models showed that the average achievement gain across the district was .94 in reading, and .86 in math (output from ANOVA models not shown). Again, the test scores under analysis are in grade equivalents; so, the reading coefficient represents a little over a nine months gain, and the math coefficient represents close to a nine months gain.

The statistical model examines whether test score gains for reading and math, between Spring 2000 and 2001, are affected by participation in Lighthouse, controlling for demographics, participation in the Summer Bridge program, whether students were retained, and whether students moved around from school-to-school. It is expected that students who participated in Lighthouse will make gains over students who did not participate in Lighthouse (see Appendix for HLM models). It should be noted, however, that these gains will not reflect parity with other non-Lighthouse students' test scores because the primary reason for Lighthouse participation in to be at-risk of retention. These gains

will only reflect that Lighthouse participants, given their initial performance in 2000, are learning more because of access to additional learning time.

Lighthouse instructional time. The second question guiding this study is whether instructional activities and organizational characteristics of the Lighthouse hour, as reported by teachers, vary across Lighthouse programs. Two-level HLM models will be used to assess the degree to which Lighthouse instructional activities (that is, test prep and remediation activities) and organizational characteristics (that is, small class size and teaching the same students) vary across programs. Of particular interest is whether Lighthouse instructional activities and organizational characteristics vary by school demographics and the type of Lighthouse structure employed by the principal (that is, extended school day, the percent of student body served, and the frequency of the program). The initial ANOVA models for the test preparation and remediation measures showed very little between-school variance, suggesting that teachers tend to specialize the Lighthouse hour for what they believe their students specifically need. Therefore, these models will not be discussed further. The 'class size' model and 'same students' model will be the continued

focus of the Lighthouse instructional time variables (see Appendix for models).

The initial ANOVA model for class size indicated that, on average, about one-third of the teachers reported that they taught the same students in Lighthouse as they did during the regular school day; and the between-school variance is 20 percent, suggesting that there is room to explain between-school differences with the school-level variables. The initial ANOVA model for 'same students' indicated that, on average, about half of the teachers reported that they had class sizes of 15 or fewer students during Lighthouse; and the between school variance is 18 percent, suggesting that there is room to explain between school differences with the school-level variables (output from ANOVA models not shown).

Results

Descriptives. Table 1 provides descriptives of Lighthouse participant characteristics. Lighthouse students are predominantly African American (49%) and Hispanic (40%); and close to 90% receive free or reduced-price lunches. Approximately 11% of these Lighthouse students also participated in the Summer Bridge

program during the previous summer. Table 2 provides means and standard deviations of Lighthouse schools. Forty percent of the Lighthouse schools have at least 41% or more of their student body attending Lighthouse; and nineteen percent have a Lighthouse program that meets 3 or more days a week for over an hour with at least seven grades in the school attending (Full program, 60 minutes plus). Table 3 presents results from a crosstabulation of school-level race, poverty, and achievement demographics by various Lighthouse programming characteristics. Predominantly African American and low-normed (less than 20% reading at or above national norms) schools serve more of their student bodies.

Achievement model. The objective of these analyses was to examine whether Lighthouse participation is related to student performance in reading and mathematics. In Table 4, the HLM results are presented. The Lighthouse coefficient (.14, t = 10.331) indicates that, on average, students who participated in Lighthouse had achievement gains in reading; and these students also had achievement gains in math (.10, t = 8.660). In practical terms, the Lighthouse-effect means that, controlling for demographics, Summer Bridge participation, and other variables, the average student gain in reading is over 1 month higher than other students;

and the average student gain in math equates to about 1 month. The results also indicate that the relationship between Lighthouse participation and student reading gains is stronger in predominantly African American schools (.15, t = 5.055); and the relationship between Lighthouse participation and student math gains is stronger in high poverty schools (.07, t = 2.418) and schools on probation (.12, t = 3.104).

Lighthouse instructional time. The goal of these analyses was to examine whether activities and organizational characteristics of the Lighthouse hour, as reported by teachers, vary across Lighthouse programs. As stated earlier, the initial ANOVA models for the test preparation and remediation measures showed very little between-school variance, suggesting few patterns across schools. It appears that teachers spent time during the Lighthouse hour focusing on the particular needs of their students. This finding is substantiated by Smith's et al. (2001) observations of Lighthouse programs. Since teachers either taught their regular students or students in the same grade as their regular students, they had a more in-depth knowledge of the types of skills that needed to be fine-tuned in their students and focused instruction accordingly (Smith et al., 2001).

Since the initial ANOVAs for the 'class size' model and 'same students' model showed between-school variances of 20% and 18%, respectively, these models will be the continued focus of the Lighthouse instructional time analyses. Of particular interest is whether these Lighthouse organizational characteristics vary by school demographics and the type of Lighthouse structure employed by the principal (that is, extended school day, the percent of student body served, and the frequency of the program). Tables 5 and 6 present the results.

In Table 5, the results indicate that about half of the teachers reported class sizes of 15 students or less (.51, t = 21.44). In integrated schools (-.14, t = -2.236) and schools serving 10% or more limited English proficiency students (-.11, t = -2.223), there were fewer teachers reporting class sizes of 15 students or less. In schools that offered Lighthouse over three days a week for over 60 minutes with at least seven grades being served (full60minplus), more teachers reported smaller class sizes (.16, t = 2.779). This model accounts for 18% of the between-school variance.

In Table 6, the results indicate that about one-third of teachers reported that they taught the same students during Lighthouse as they taught during the regular school day (.31, t =

16.614). High poverty schools had fewer teachers who taught the same students (-.17, t = -2.911) as well as teachers in schools that offered Lighthouse more than three days a week for over 60 minutes (-.14, t = -3.135). However, in predominantly minority schools (.16, t = 2.660), schools with extended days (.13, t = 3.002), and schools that serve 41% or more of their student body (.12, t = 2.878), more teachers reported that they taught the same students in Lighthouse and the regular instructional day. This model accounted for 50% of the between-school variance.

Conclusion

Along with ending social promotion in Chicago, low-achieving students have been given additional supports, namely extra instructional time attached to the school day (Lighthouse) and summer instructional time (Summer Bridge). This paper examined the impact of Lighthouse participation on student performance, as well as determining whether school demographic characteristics accounted for variations in Lighthouse programming. The guiding concern was whether Lighthouse, with the goal of providing additional support for low achievers, would

actually mirror the inequalities between schools in the school system.

The HLM achievement analyses show that, between 2000 and 2001, Lighthouse students made one-month gains in reading and math over non-Lighthouse students.[3] This result is promising because, since the program actually only amounts to about one month of instruction per year, the district is actually getting its money's worth. The achievement analyses also suggest that Lighthouse students in predominantly African American schools are performing better in reading than their counterparts in schools that are not predominantly African American; and Lighthouse students in high poverty schools are doing better in math than their counterparts in schools without high poverty percentages. Alexander's et al. (2001) work suggests that additional learning time is particularly beneficial in communities where, because of social and economic shortcomings, there are limited options for supplementary learning experiences (such as enrichment programs, youth groups). In this vein, simply being in Lighthouse (versus no

[3] One concern of this study is whether these gains are actually a programmatic-effect or an effect of targeted-instruction in Chicago, which has honed in on the low-achievers. Further analyses will attempt to answer this question. Additional analyses will also attempt to address how, if at all, instructional techniques during Lighthouse affects test score gains.

activity at all) will affect learning gains, particularly for disadvantaged students.

The Lighthouse instructional time analyses provide mixed answers to the question of whether differences in Lighthouse programming varied across schools. On the one hand, Lighthouse students in high poverty schools were least likely to be taught by their regular school day teacher whereas, in predominantly minority schools, Lighthouse students were likely to have the same teacher from the regular school day. Instead of concentrating on demographics as the basis of how resources were distributed, the results of this study compel us to concentrate on the needs of the student body. Having your same teacher appears to be more of a matter of logistics that is, in schools serving more of their student body or schools choosing to extend the school day, students will tend to have their same teacher. However, the crosstabulations presented earlier suggest that predominantly African American and low-normed schools are more likely to extend the school day and/or serve more students.

Ending social promotion in Chicago is a mixed blessing. While low performing students are getting more attention and resources than they have in the past (Roderick et al., 1999;

Roderick & Engel, forthcoming), they are also being subjected to the fear of retention and instruction that is influenced by passing rates. For the short term, these additional resources definitely matter because students are improving. However, at this point, we're not sure of the policy's impact on students' critical thinking skills, self-perception, and love for learning. After all, it will be these characteristics that matter most in adulthood.

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APPENDIX

Rasch Measures

[Survey items that were the easiest to agree with are at the bottom and the items nearer the top were the most difficult with which to agree.]

Time Spent on Test Preparation Measure (Reliability = .74)	Point Biserial Correlation
I do practice tests using the Test Best or other test prep workbooks	.80
I teach test taking skills	.76
I focus on the content covered by the ITBS	.74

Level of Remediation Measure (Reliability = .62)	Point Biserial Correlation
I use the time to help students get a start on their homework	.49
I use the hour to continue my regular day lessons	.67
I do activities I don't have time to do during the day (e.g., writing workshops, book talks, computer work, projects)	.64
I use the time to reinforce skills learned during the school day	.74
I help students catch up on reading and math skills in which they are deficient	.42

HLM Models[4]

Achievement model:

Level-1 model: $Y_{ij} = \beta_{0j} + \beta_{1j}(Bridge_{ij}) + \beta_{2j}(Lighthouse_{ij}) + \beta_{3j}(Female_{ij}) + \beta_{4j}(Retain_{ij}) + \beta_{5j}(Mobile_{ij}) + \beta_{6j}(Afr\text{-}Amer_{ij}) + \beta_{5j}(Freelunch_{ij}) + r_{ij}$ where:

Y_{ij} is the predicted test score gain of student *i* in school *j*;
β_{0j} is the mean test score gain in school *j*;
β_{nj} are the level-1 regression coefficients for each school *j*;

[4] In the Lighthouse instructional time models (shown below), I did not account for the dichotomous outcomes by running a non-linear model (Bernoulli). Additional analyses (not shown) computing the probability of having a small class size and the probability of having the same students were similar to the results discussed in this paper.

Bridge (1 = Bridge student in Summer 2000; 0 = not a Bridge student), Lighthouse (1 = Lighthouse student in 2000-01 school year; 0 = not a Lighthouse student), Female (1 = female; 0 = male), Retain (1 = retained in 2000; 0 = not retained), Mobile (1 = moved around from school to school; 0 = stable), Afr-Amer$_{ij}$ (1 = African American student; 0 = Other), Freelunch$_{ij}$ (1 = receive free or reduced price lunch; 0 = Other), are level-1 predictors for student *i* in school *j*; and r_{ij} is a level-1 residual term, normally distributed with mean 0 and variance σ^2

Level-2 model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}$ (PredAfAm$_j$) $+ \gamma_{02}$ (HiPovty$_j$) $+ \gamma_{03}$ (Prob99$_j$) $+ \gamma_{04}$ (Lownorms$_j$) $+ u_{0j}$

$\beta_{1j} = \gamma_{10} + u_1$

$\beta_{2j} = \gamma_{20} + \gamma_{21}$ (PredAfAm$_j$) $+ \gamma_{22}$ (HiPovty$_j$) $+ \gamma_{23}$ (Prob99$_j$) $+ \gamma_{24}$ (Lownorms$_j$) $+ u_2$

$\beta_{3j} = \gamma_{30}$

$\beta_{4j} = \gamma_{40}$

$\beta_{5j} = \gamma_{50}$

$\beta_{6j} = \gamma_{60} + u_6$

$\beta_{7j} = \gamma_{70}$

γ_{00} is the average of the school gains across all schools
γ_{pj} are the level-2 coefficients influencing mean gains in school *j*
PredAfAm$_j$ (1 = 85% or more African American; 0 = Other), HiPovty$_j$ (1 = 75% or more low income; 0 = Other), Prob99$_j$ (1 = school was on probation in 1999; 0 = not on probation), and Lownorms$_j$ (1 = less than 20% of student body reading at national norms; 0 = Other) are the level-2 predictors for school *j*; and
u_{oj} is a level-2 residual term, normally distributed with mean 0 and variance σ^2

These paramenters have been adjusted for other variables in the model.
The β_{3j}, β_{4j}, β_{5j}, and β_{7j} coefficients did not systematically vary across schools (results not shown); thus, they are treated as fixed coefficients in this model.

Lighthouse Instructional Time models ('same students'):

Level-1 model: $Y_{ij} = \beta_{0j} + r_{ij}$ where:

Y_{ij} represents whether teacher *i* in school *j* has his/her same students during Lighthouse;
β_{0j} is the proportion of teachers with their same students in school *j*;

r_{ij} is a level-1 residual term, normally distributed with mean 0 and variance σ^2

Level-2 model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{PredAfAm}_j) + \gamma_{02}(\text{HiPovty}_j) + \gamma_{03}(\text{Prob00}_j) + \gamma_{04}(\text{Lownorms}_j) + \gamma_{05}(\text{Full60minplus}_j) + \gamma_{06}(\text{Pctatlh}_j) + \gamma_{07}(\text{Extday}_j) + \gamma_{08}(\text{PredMnty}_j) + \gamma_{09}(\text{PctLEP}_j) + u_{0j}$

γ_{00} is the average proportion of teachers with their same students across all schools
γ_{pj} are the level-2 coefficients influencing mean proportions in school *j*
PredAfAm_j (1 = 85% or more African American; 0 = Other), HiPovty_j (1 = 75% or more low income; 0 = Other), Prob00_j (1 = school was on probation in 2000; 0 = not on probation), Lownorms_j (1 = less than 20% of student body reading at national norms; 0 = Other), Full60minplus (1 = offered Lighthouse more than 3 days a week for more than an hour to seven grades or more; 0 = Other), Pctatlh (1 = 41% or more of student body being served at Lighthouse; 0 = Other), Extday (1 = principal extended the school day; 0 = Lighthouse is a separate and distinct after-school program), PredMnty (1 = less than 15% white; 0 = Other), PctLEP (1 = 10% or more students receiving services due to limited English proficiency; 0 = Other) are the level-2 predictors for school *j*; and
u_{oj} is a level-2 residual term, normally distributed with mean 0 and variance σ^2

These paramenters have been adjusted for other variables in the model.

Lighthouse Instructional Time models ('small class size'):

Level-1 model: $Y_{ij} = \beta_{0j} + r_{ij}$ where:

Y_{ij} represents whether teacher *i* in school *j* has a small class size during Lighthouse;
β_{0j} is the proportion of teachers with a small class size in school *j*;
r_{ij} is a level-1 residual term, normally distributed with mean 0 and variance σ^2

Level-2 model:

$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Full60minplus}_j) + \gamma_{02}(\text{Integrated}_j) + \gamma_{03}(\text{PctLEP}_j) + u_{0j}$

γ_{00} is the average proportion of teachers with small class sizes across all schools

γ_{pj} are the level-2 coefficients influencing mean proportions in school *j*
Full60minplus (1 = offered Lighthouse more than 3 days a week for more than an hour to seven grades or more; 0 = Other), Integrated (1 = 30% or more of student body is white; 0 = Other); PctLEP (1 = 10% or more students receiving services due to limited English proficiency; 0 = Other) are the level-2 predictors for school *j*; and
u_{oj} is a level-2 residual term, normally distributed with mean 0 and variance σ^2

These paramenters have been adjusted for other variables in the model.

Tables

Table 1. Means and standard deviations of Lighthouse student characteristics.

Variables	Mean	SD
Summer Bridge	0.11	.32
African American	0.49	.50
Hispanic	0.40	.50
White	0.09	.28
Female	0.55	.50
Free Lunch	0.89	.32
Retained	0.04	.20
Mobile	0.02	.15
Reading gain	1.06	1.02
Math gain	0.96	.66

Table 2. Means and standard deviations of Lighthouse school characteristics.

Variables	Mean	SD
Full Program, 60 minutes plus	0.19	.39
41% or more attending Lighthouse	0.40	.49
Extended school day	0.36	.48
Predominantly African American	0.47	.50
Predominantly Minority	0.75	.44
Integrated	0.14	.35
High Poverty	0.82	.38
10% or more limited English Proficiency	0.45	.50
Probation 2000	0.08	.28
Probation 1999	0.11	.31
Low Norms	0.12	.32

Table 3. Demographic characteristics by Lighthouse programming features

	Full Program, more than one hour	41% or more attending Lighthouse	Extended school day
Predominantly African American (n = 99)	23%	53%	48%
Integrated (n = 30)	13%	23%	30%
High Poverty (n = 174)	22%	43%	39%
Low Norms (n = 23)	12%	57%	50%

Table 4. HLM Estimates of Lighthouse participation on Reading and Math Achievement gains

	Reading	Math
Mean Achievement Gain	.94 (0.005)*	.86 (0.005)*
Pred AfAm	-.02 (0.014)	-.01(0.011)
HiPovty	-.12 (0.013)*	-.04 (0.014)*
Prob99	-.04 (0.023)	-.02 (0.017)
Lownorms	-.08 (0.023)*	-.03 (0.017)*
Bridge	.42 (0.012)*	-.01 (0.012)
Lighthouse	.14 (0.014)*	.10 (0.012)*
Pred AfAm	.15 (0.03)*	.03 (0.025)
HiPovty	-.03 (0.03)	.07 (0.029)*
Prob99	.10 (0.057)	.13 (0.041)*
Lownorms	.001 (0.062)	-.06 (0.056)
African American	-.10 (0.01)*	-.06 (0.006)*
Female	.05 (0.004)*	.01 (0.003)
Free Lunch	-.06 (0.009)*	-.02 (0.005)*
Retained	-.27 (0.014)*	-.15 (0.01)*
Mobile	-.05 (0.012)*	-.05 (0.01)*

* $p \leq .05$
Standard errors in parentheses

Table 5. HLM Estimates of Lighthouse Instructional Time (Small Class Size Model)

	Small Class Size
Mean proportion of teachers with small class size	.51 (0.023)*
Full60minplus	.17 (0.05)*
Integrated	-.14 (0.063)*
PctLEP	-.11 (0.048)*

* $p \leq .05$
Standard errors in parentheses

Table 6. HLM Estimates of Lighthouse Instructional Time (Same Students Model)

	Same Students
Mean proportion of teachers with same students	.31 (0.019)*
Full60minplus	-.14 (0.05)*
Pctatlh	.12 (0.043)*
Extday	.13 (0.044)*
Pred AfAm	-.15 (0.079)
PredMnty	.16 (0.062)*
HiPovty	-.17 (0.058)*
PctLEP	-.09 (0.066)
Prob00	.05 (0.074)
Lownorms	-.07 (0.07)

* $p \leq .05$

Standard errors in parentheses

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