Student-Level Analysis of Year 1 (2003 – 2004) Achievement Outcomes for Tennessee Charter Schools

Steven M. Ross and Aaron J. McDonald
Center for Research in Educational Policy
The University of Memphis

Brenda McSparrin Gallagher
Office of Research and Evaluation
Memphis City Schools

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Abstract

This report presents student-level achievement results for the four charter schools that began operation in Tennessee during the 2003-04 academic year. To conduct a rigorous and valid analysis of student achievement outcomes at these schools, we employed a matched program-control design at the student level, whereby each charter school student was paired to a comparable "control" student attending the same or similar school during 2002-03. The four charter schools were: Circles of Success in Learning Academy (COSLA), Memphis Academy of Health Sciences (MAHS), Memphis Academy of Science and Engineering (MASE), and the Smithson-Craighead Academy (SCA). The first three schools are located in Memphis and the fourth in Nashville. Participants in the study were 14 second graders from COSLA, 70 sixth graders from MAHS, 134 seventh graders from MASE, and 9 fourth graders from SCA. All had scores on the spring, 2003 (pre-implementation or "pretest") and the spring, 2004 (posttest) Tennessee Comprehensive Assessment Program/Achievement Test (TCAP/AT) in Reading, Language Arts, and Math.

The analyses of 2004 TCAP/AT scores for the three Memphis cohort schools showed directional advantages for the charter school students over their matched control counterparts on all three subtests. However, only the effect for MASE in Math was statistically significant. The median effect sizes were +0.15 for test scores unadjusted for pretest differences and +0.12 for adjusted scores, indicating small to moderate effects. When the results for all three schools were combined, significant

advantages for the charter school students occurred on both Reading (*ES* = +0.19) and Math (*ES* = +0.19), with a directional advantage in Language Arts (*ES* = +0.12). Attendance was also significantly higher at two of the Memphis schools and directionally higher at the third. For SCA, however, the comparisons to control students yielded comparable to negative results. Because only 9 student matches were available for SCA, these results need to be viewed very cautiously relative to those from the three schools and much larger sample sizes in the Memphis cohort.

Overall, the first-year achievement outcomes seem highly suggestive and impressive in view of the: (a) early (first-year) implementation of the charter school programs; (b) charter school students' transition to new schools, a factor normally associated with lower achievement; and (c) comparable magnitude of the effect sizes in Memphis to those obtained in prior research on established comprehensive school reform (CSR) models. The present study will be replicated over the next several years to examine first-year results for newly established charter schools and longitudinal outcomes for the entire population of Tennessee charter schools.

Student-Level Analysis of Year 1 (2003 – 2004) Achievement Outcomes for Tennessee Charter Schools

This report presents student-level achievement results for the four charter schools that began operation in the State of Tennessee in the 2003-04 academic year. To conduct a rigorous and valid analysis of student achievement outcomes at these schools, we employed a matched program-control design at the student level, whereby each charter school student was paired to a comparable "control" student attending the same or similar school during 2002-03. Such a design has the critical advantages of controlling for pre-program achievement and other relevant student and school variables.

Description of the Charter Schools

Three of the charter schools established in 2003-04 were located in Memphis. Their characteristics are described briefly below.

Circles of Success in Learning Academy (COSLA). COSLA is an urban school located in Memphis, Tennessee. In the first year, 60 African American students were enrolled, with 20 students each, in one classroom per grade, in grades K, 1, and 2. Of the 60 students, 66.6% receive free or reduced-price lunch. As a literacy-focused school using the Success for All reading program, COSLA emphasizes the integration of reading and writing activities across all curricular areas.

Memphis Academy of Health Sciences (MAHS). MAHS is located in a high-poverty area north of downtown Memphis, Tennessee. There are 99 students attending grade 6, the only grade served this first year. African American students represent

100% of the school's population; 77% of the students receive free or reduced-price lunches. The curriculum developed and employed at MAHS is a standards–based, interdisciplinary program that incorporates projects and experiential learning centered on a health sciences theme.

Memphis Academy of Science and Engineering (MASE). MASE is located in downtown Memphis in an urban medical center district surrounded by the University of Tennessee Health Science Center. For the first year, the school opened with 147 seventh-grade students of which 97.9% were African American, 1.4% Caucasian, and 0.7% Latino. Nearly two-thirds (65% or 96 students) qualified for free or reduced-price lunch. The main focus of the school for this first year was to foster a sense of school family/community, improve the Language Arts skills of the students, and to create a culture of academic excellence. The goal of the principal and primary stakeholder is to make a showcase charter school that created the science and math leaders of tomorrow.

The fourth charter school was located in Nashville, and is described below.

Smithson-Craighead Academy (SCA). This urban charter school is located in the city of Nashville, Tennessee. The mission of the school is to provide basic academic skills necessary to prepare students for success throughout their K-12 academic education. The student population consists of approximately 155 kindergarten through fourth grade students who previously attended schools designated "at-risk." The student population is 99% African-American.

Method

Participants in the study were 14 second graders from COSLA, 70 sixth graders from MAHS, 134 seventh graders from MASE, and 9 fourth graders from SCA All had scores on the spring, 2003 (pre-implementation or "pretest") and the spring, 2004 (posttest) Tennessee Comprehensive Assessment Program/Achievement Test (TCAP/AT) in Reading, Language Arts, and Math. Normal Curve Equivalent (NCE) scores, a standard score distribution with a mean of 50, were used in all analyses.

For the Memphis cohort, each charter school student was matched with a control student based on eight criteria: 2002-03 enrollment (at the same school as the charter school counterpart), grade level, race, gender, free/reduced price lunch status, and the 2003 subtest scores on TCAP/AT in Reading, Language Arts, and Math. When an appropriate match for a charter school student could not be found from his/her former (2002-03) school, the closest match from one of the schools formerly attended by his/her present classmates was selected using all other criteria.

For SCA, there were only 21 students who took the TCAP/AT in 2004. Of these, only 14 had pretest (2003) scores. This subsample was further reduced to 9 by applying the above control-student matching procedure, excluding the gender variable; and to only 5 if gender were included. It was therefore decided to use the former, larger subsample to permit an exploratory inferential (comparative) statistical analysis. Because of the small sample size, however, and unique conditions in the schools relationship to their respective parent districts and community sponsors in the two cities, we present the Memphis and Nashville results in separate sections below.

Memphis Results

Pre-Implementation

Descriptive Results

Descriptive statistics for pre-implementation measures (2003) are presented in Table 1. In the year prior to enrollment in the charter schools, students in COSLA and MAHS, as well as their respective matched-control samples, scored below the national norm (50) on all three subtests (Reading, Language Arts, and Mathematics). MASE students and their matched controls had mean NCE scores slightly below the national norm on the Mathematics subtest but higher than the national norm on the Reading and Language Arts subtests. As can be seen in the table, the effect sizes[1] (*ES*) comparing charter and control pretest means were extremely small, suggesting a high degree of comparability.

[1] Effect sizes indicate the number of standard deviations by which the "program" or experimental group surpasses the control group. An *ES* > 0.25 would be considered to be strong and educationally meaningful.

Table 1

Descriptive NCE statistics for Charter School Students and Control Students on the 2002-2003 TCAP/AT

Program		Spring 2003 (pre-test) TCAT/AT Subtest		
		Reading	Language Arts	Mathematics
Circles of Success N=14				
	GRADE 1 Mean	45.57	45.07	35.00
	Standard Deviation	21.17	20.56	16.59
Control Students N=14				
	GRADE 1 Mean	44.43	42.36	36.14
	Standard Deviation	20.87	20.85	15.28
	Effect Size	**+0.05**	**+0.13**	**-0.07**
Memphis Academy of Health Sciences N=70				
	GRADE 5 Mean	42.14	43.76	40.14
	Standard Deviation	17.64	19.02	15.20
Control Students N=70				
	GRADE 5 Mean	42.21	43.00	40.41
	Standard Deviation	17.09	18.28	15.37
	Effect Size	**0.00**	**+0.04**	**-0.02**
Memphis Academy of Science & Engineering N=134				
	GRADE 6 Mean	57.58	56.15	49.25
	Standard Deviation	16.64	15.81	15.81
Control Students N=134				
	GRADE 6 Mean	57.22	56.19	49.71
	Standard Deviation	16.70	14.86	15.56
	Effect Size	**+0.02**	**+0.00**	**-0.03**

Note: The means represent scores in the year and grade prior to students' charter school enrollment.

Inferential Results

Separate one-way ANOVAs to determine charter school and control group equivalence revealed non-significant results for all three subtests (Reading, Language Arts, and Mathematics). Thus, there is no basis for inferring that charter and control students differed in achievement in the grade prior to charter school enrollment.

Post-Implementation

Correlational Results

Correlations between the pre- and post-implementation measures for COSLA were at least close to moderate in strength. For Reading, r = +.43 (p<.05); for

Language Arts r = +.47 (p<.05); and for Math, r = +.61 (p<.01). Intercorrelations among the pre- and post-implementation measures ranged from +.36 to +.61.

Pre- and post-implementation correlations for MAHS were all statistically significant and moderate to strong in magnitude: Reading, r = +.60 (p<.01); Language Arts,

r = +.75 (p<.01); and Math, r = +.81 (p<.01). Intercorrelations ranged from +.58 to +.81.

MASE also had moderate to strong pre- and post-implementation correlations, which were statistically significant: Reading, r= +.72 (p<.01); Language Arts, r = +.69 (p<.01); and Math, r = .81 (p<.01). Intercorrelations ranged from +.61 to +.81.

Descriptive Results

Descriptive statistics for post-implementation measures are presented in Table 2. COSLA (M = 48.07) and MAHS (M = 46.46) students scored close to the national norm of 50 in Language Arts, whereas MASE students approximated or exceeded the national norm on all subtests. Inspection of the unadjusted means shows that the three charter schools directionally surpassed the control students on all three subtests, with *ES*s ranging from +0.03 to +0.69.

Table 2

Descriptive NCE statistics for Charter School Students and Control Students on the 2003-2004 TCAP/AT

Program		NCE Scores for Spring 2004 (post-test) TCAT/AT Subtest		
		Reading	Language Arts	Mathematics
Circles of Success N=14				
	Mean	40.29	48.07	36.64
	Adjusted Mean	39.68	47.66	36.21
	Standard Deviation	12.56	12.56	17.07
Control Students N=14				
	Mean	37.29	38.64	36.29
	Adjusted Mean	37.89	39.05	36.70
	Standard Deviation	19.86	13.67	13.59
	Effect Size	**+0.15**	**+0.69**	**+0.03**
	Adjusted Effect Size	**+0.09**	**+0.63**	**-0.04**
Memphis Academy of Health Sciences N=70				
	Mean	43.47	46.46	39.81
	Adjusted Mean	43.42	46.31	39.82
	Standard Deviation	13.75	16.61	15.79
Control Students N=70				
	Mean	40.36	42.91	38.03
	Adjusted Mean	40.40	43.06	38.03
	Standard Deviation	15.34	17.97	16.91
	Effect Size	**+0.20**	**+0.20**	**+0.11**
	Adjusted Effect Size	**+0.20**	**+0.18**	**+0.11**
Memphis Academy of Science & Engineering N=134				
	Mean	51.50	55.43	48.71
	Adjusted Mean	51.49	55.47	48.84
	Standard Deviation	17.00	20.42	15.65
Control Students N=134				
	Mean	49.66	54.49	45.81
	Adjusted Mean	49.67	54.46	45.68
	Standard Deviation	15.82	16.97	15.45
	Effect Size	**+0.12**	**+0.06**	**+0.19**
	Adjusted Effect Size	**+0.12**	**+0.06**	**+0.20**

Inferential Analyses

A multivariate analysis of covariance (MANCOVA) was used to assess program effects. Each charter school and its matched control group were compared on the 2004

TCAP/AT Reading, Language Arts, and Mathematics subtests. The 2003 (pretest) TCAP/AT subtests were used as covariates.

Circles of Success Learning Academy – Grade 2. The 2003 Language Arts subtest was the only significant covariate in the MANCOVA ($p<.02$). The multivariate effect of Program did not reach significance, $F(3,23)=2.32$, $p=.10$, $eta^2=.232$. Thus, the COSLA and matched control means were not significantly different on the various subtests. In interpreting these results, it is important to consider that the very small sample size of 14 matched pairs limits the power of the analysis for detecting program effects. For example, the directional superiority of COSLA in Language Arts (*ES* = +0.69) is suggestive of an educational impact that might prove highly meaningful and significant with a larger sample.

Memphis Academy of Health Sciences – Grade 6. The Reading, Language Arts, and Math covariates were all highly significant in the MANCOVA (all *p*'s<.02). The multivariate effect of Program, however, did not reach significance, $F(3,133)=1.15$, $p=.331$, $eta^2=.025$. Thus, despite the directional superiority of the MAHS over the matched control students on all three subtests, the effects were not sufficiently large to indicate reliable differences between groups.

Memphis Academy of Science and Engineering – Grade 7. The three covariates were all highly significant in the MANCOVA (all *p*'s <.000). Of note, the multivariate effect of Program was also significant, $F(3,261)=3.10$, $p=.027$, $eta^2=.027$. Univariate tests (ANCOVA) were conducted on each of the dependent measures (Reading, Language Arts, and Math subtests). The univariate results were significant for the Math subtest only, $F(1,263)=8.89$, $p=.003$, $eta^2=.033$. As shown in Table 2, the directional

superiority of MASE students over the control students on the Reading and Language Arts subtests was not found to be statistically significant.

Aggregate Memphis Results

Supplementary analyses examined the combined results for the three schools. Although combining the results offers the advantage of increased sample size and higher statistical power, it has the disadvantage of treating as psychometrically equivalent NCE scores from varied charter school programs and especially, from different grade levels directly confounded with (specific to) the programs being studied.

Pre-Implementation

Descriptive statistics for pre-implementation measures are presented in Table 3. In the year prior to enrollment in the charter schools, the charter students and the matched control students scored above the national norm (50) on two out of three subtests (e.g., Reading and Language Arts).

Table 3

Aggregate Descriptive NCE statistics for Charter School Students and Control Students on the 2002-2003 TCAP/AT

Program		Spring 2003 (pre-test) TCAT/AT Subtest		
		Reading	Language Arts	Mathematics
Charter Schools N=218				
	Mean	51.85	51.46	45.41
	Standard Deviation	18.67	18.13	16.38
Control Students N=218				
	Mean	51.58	51.06	45.85
	Standard Deviation	18.47	17.60	16.19
	Effect Size	**+0.01**	**+0.02**	**-0.03**

Separate one-way ANOVAs to determine charter school and control group equivalence revealed non-significant results for all three subtests (Reading, Language Arts, and Mathematics). As indicated by a visual comparison of means and the near-zero effect sizes, the charter school group performed similarly to matched control group on the pre-implementation measures

Post-Implementation

Descriptive statistics for post-implementation measures are presented in Table 4. As can be seen, the charter school group demonstrated a directional advantage over the control group on all three subtests.

Table 4

Aggregate descriptive NCE statistics for Charter School Students and Control Students on the 2003-2004 TCAP/AT

Program		Spring 2004 (post-test) TCAT/AT Subtest		
		Reading	Language Arts	Mathematics
Charter Schools N=218				
	Mean	48.20	52.08	45.08
	Adjusted Mean	48.19	52.03	45.19
	Standard Deviation	16.27	19.26	16.39
Control Students N=218				
	Mean	45.88	49.76	42.70
	Adjusted Mean	45.00	49.81	42.59
	Standard Deviation	16.59	18.09	16.25
	Effect Size	**+0.14**	**+0.13**	**+0.15**
	Adjusted Effect Size	**+0.19**	**+0.12**	**+0.16**

A multivariate analysis of covariance (MANCOVA) was used to assess program effects. All three covariates were highly significant in the MANCOVA (all *p*'s <.001). The multivariate effect of Program was also significant, $F(3,429)=3.22$, $p=.023$, $eta^2=.022$. Univariate tests (ANCOVA) were conducted on each of the dependent

measures (Reading, Language Arts, and Math subtests). The univariate results were significant for the Reading subtest, $F(1,431)=4.68$, $p=.031$, $eta^2=.011$, and for the Math subtest, $F(1,431)=8.65$, $p=.003$, $eta^2=.020$. The univariate results for the Language Arts subtests were not significant, but approximated the .05 alpha level, $F(1,431)=3.56$, $p=.060$, $eta^2=.008$. As shown in Table 4, weak to moderate adjusted mean effect sizes, ranging from +0.12 (Language Arts) to +0.19 (Reading), were obtained.

Memphis Attendance Results

Supplemental analyses examined attendance (absences) rates for students at the three Memphis schools compared to their matched control student counterparts. In two of the three comparisons, results were significant and reflecting lower absence rates in the charter schools. Specifically, large and significant advantages were shown for both MAHS (M_{abs} = 4.33% vs. 6.85% for controls), $t(136)= 2.46$, $p = .015$, ES = +0.34; and MASE (M_{abs} = 3.13% vs. 4.74% for controls), $t(266)= 2.71$, $p = .007$, ES = +0.274 Noting the much smaller sample sizes involved, a nonsignificant directional advantage was indicated for COSLA, (M_{abs} = 3.56% vs. 6.11% for controls), $t(26)= 1.99$, $p = .057$, ES = +0.61.

Nashville Results

Both pretest (2002-03) and posttest (2003-04) results for SCA are summarized in Table 5. The table also provides the results of *t* tests conducted to compare inferentially the SCA and control student means. As shown on the table, both groups scored nearly identically in the pre-implementation year, thus verifying the accuracy of the matched-pair procedure. On the posttest, SCA had a lower mean than the control group in Reading (ES = -.12) and especially in Mathematics (ES = -0.54). Neither of these

differences was statistically significant, however. Because there were only 9 matched pairs involved in the analyses and gender could not be employed as a matching variable, these results need to be viewed with a high degree of caution.

Table 5

Descriptive and inferential NCE statistics for Smithson-Craighead Academy (SCA) Students and Control Students on the 2002-03 and 2003-2004 TCAP/AT

				Normal Curve Equivalent Score (NCEs)		
Program	**Year**	**Grade**	**Statistic**	**Reading**	**Language Arts**	**Math**
Smithson Craighead (n = 9)	**02-03**	**3**	Mean	43.11	45.67	47.56
			Standard Deviation	8.51	8.70	12.60
Control (Matched Case) (n = 9)	**02-03**	**3**	Mean	42.56	45.22	46.78
			Standard Deviation	8.81	9.82	11.19
			t - value (*p*)	.14 (.893)	.10 (.920)	.14 (.892)
			Effect Size	+0.06	+0.05	+0.07
Smithson Craighead (n = 9)	**03-04**	**4**	Mean	40.22	45.00	35.00
			Standard Deviation	9.14	9.12	12.39
Control (Matched Case) (n = 9)	**03-04**	**4**	Mean	40.22	46.56	41.33
			Standard Deviation	8.90	16.89	11.18
			t - value (*p*)	0.00 (1.000)	-.24 (.811)	-1.14 (.272)
			Effect Size	0.000	-0.12	-0.54

Conclusions

Results from the first-year analyses of student achievement in the three Memphis charter schools should be interpreted as positive overall. Specifically, means on all three subtests of the TCAP-AT directionally favored students from each of the three charter schools over matched-control counterparts attending similar district schools. Statistically significant advantages were obtained for MASE students in Math and the combined charter school (three-school) sample in Math and Reading. Attendance was also significantly higher at two of the schools and directionally higher at the third. The encouraging findings for the Memphis cohort, however, were not replicated in the

exploratory analysis of the 9 available matched pairs for the Nashville school (SCA). It is expected that larger sample sizes in the Year 2 study (2004-05) will permit a more meaningful analysis of SCA's level of success in raising student achievement.

It is important to note that compared to prior research (Bulkley and Fisler, 2002; Greene, Forster, & Winters, 2003), particularly the recent highly criticized study by the American Federation of Teachers (Page, 2004), our design provided rigorous control over the students to which the charter school samples were compared. Specifically, each control student was one who relative to his/her charter school counterpart: (a) either attended the same school or a highly similar school during the prior year; (b) was of the same race, gender, and poverty status; and (c) scored similarly on all three TCAP/AT subtests prior to charter school enrollment. The high degree of program-control group comparability helps to eliminate sampling bias as a threat to the validity of the findings.

The positive trends in the first-year Memphis achievement outcomes are certainly encouraging. Still, we recommend that caution be exercised before reaching certain conclusions. First, without adjusting for pretest scores, the median effect size out of the nine obtained (3 schools x 3 subtests) is +0.15, indicating a weak to moderate effect (Cohen, 1988). With the pretest adjustment, the median falls slightly to +0.12. Second, out of the 12 inferential posttest (2004) comparisons (the above 9 plus the 3 aggregate analyses), only 3 were statistically significant: Math for MASE (*ES* = +0.20) and Reading (*ES* = +0.19) and Math (*ES* = +0.16) for the combined schools. Lack of significance indicates an unacceptable probability (> 5%) that the differences obtained may be due to chance. A third consideration is that, even though the charter and

control samples are highly similar demographically, the former might still have the advantage, manifested through the school "choice" option, of families that are more involved in, and perhaps more knowledgeable about, their children's education. A fourth consideration is that the positive trends were not evidenced for the Nashville charter school, although the serious limitations of having only 9 matched SCA-control group pairs has been noted throughout this report.

Given the above caveats, it seems fair to present as a counterpoint the more liberal view that even the modest advantages obtained for the three charter schools reflect substantive attainment and promise for future success. First, a widely held belief by educational reform experts and researchers is that school change takes several years to manifest itself in observable outcomes (Fullan, 2000; Sizer, 1992; Levin, 1993). Imagine restructuring a business by bringing together in a new facility, under different policies, strategies, and conditions, totally new management and employees who have never worked together before. Would higher profits be expected in the short-run than obtained the year before? As Desimone (2002) indicates in a review of research on CSR, "The slow pace of school reform affects the ability to assess implementation success, as well as the ability to measure effects on students, teachers, and parents" (p. 455). Adopting new school programs—let alone creating an entirely new school—could, due to newness and disruption, actually lower rather than raise student achievement in the first few years (see Ross et al., 2001). Second, research on school transitions performed specifically with the TCAP system (Sanders & Horn, 1995a, 1995b) and in other contexts (see Larson, Moneta, Richards, & Wilson, 2002; Larson & Richards, 2000), shows decreases in student achievement associated with changing

schools. In this regard, the entire charter school sample changed schools from 2002-03 to 2003-04, whereas only 14% of the COSLA and 54% of the MASE matched control students changed schools. Nearly all (91%) of the MAHS matched controls, however, changed schools in graduating from elementary to middle school. Third, although the median effect sizes for the individual charter students were modest in absolute size (i.e., from +0.12 to +0.15), it should be considered that in a recent meta-analytic study of 29 Comprehensive School Reform (CSR) models, Borman et al. (2003) found an overall effect size of from +0.10 to +0.14, with the range for the "most successful" category being +0.17 to +0.21. Only 3 out of the 29 models achieved this high status (Direct Instruction, School Development Program, and Success For All). In this regard, it seems quite impressive that newly opened schools mirrored the effects of well-established CSR models by raising, on the average, each enrollee over a tenth of a standard deviation compared to control students. Simply put, raising an entire school population by .10 SD would be of huge benefit both educationally and economically.

Considering the above factors, even schools with strong potential for success might demonstrate no effects or even negative outcomes in their first year. In contrast, positive patterns were evidenced here. The true test of school effectiveness, however, is not what happens in a given year, but what is sustained over time (Snipes & Casserly, 2004). Accordingly, the present study will be replicated over the next several years to examine first-year results for newly established charter schools and longitudinal outcomes for the entire population of all Tennessee charter schools.

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