2004 Final Report

Thinking Maps

North Carolina School Study

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Submitted
January 17, 2005

This study compares the gains in standardized test scores made by North Carolina schools that adopted Thinking Maps after 1997 and before 2002 and those gains made by comparable schools that did not adopt the intervention. North Carolina state assessment data from 1997 to 2002 were evaluated to ascertain the percentage of students at four performance levels for each school. Schools that adopted Thinking Maps showed statistically significant gains in students in the proficient performance level and parallel significant drops in the percent of students performing at the lowest performance level. The two groups of schools were comparable in geographic location and percent of students at the lowest socio-economic level (eligible for free or reduced lunch).

The report includes a description of the sample used in the study, description of the data used to compare the two groups of schools, the analytic approach to the data, the results of that analysis, and conclusions from this study.

Sample for Study

Initially the sample included all school buildings in North Carolina that enrolled two consecutive grades in the target range of Grades 3-8. Based on 2002 records, 1689 buildings met that qualification. We assigned each school to one of four categories: Non-adopters (coded as 0); Adopting within target years (coded as 1); Adopting before 1997, the initial target year (coded as 2); and Adopting after 2002, the final target year (coded as 3). Table 1 displays the distribution of schools over these four categories.

Table 1
TM (0=No; 1=between 97 & 2002; 2=pre 97; 3=post 2002 adopter)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	649	38.4	38.4	38.4
	1	551	32.6	32.6	71.0
	2	311	18.4	18.4	89.5
	3	178	10.5	10.5	100.0
	Total	1689	100.0	100.0	

Because schools that had adopted Thinking Maps before 1997 would presumably had made gains that were not measurable (the ABCs were not in place before 1996), we excluded the schools in category 2 (N=311 schools). We also excluded schools that adopted Thinking Maps after 2002 (N=178 schools). Consequently, twelve hundred schools in North Carolina were the sample for this study. These schools fell into two categories (non-adopters and adopting schools between 1997 and 2002).

We used data from the National Center for Educational Statistics for demographic purposes. Variables from this database included locale, ethnicity, Title I status, students on free and reduced price lunch.

Table 2 illustrates the relationship between the independent variable (TM adoption) and locale as defined by NCES. As can be seen from this table, the adopters and non-adopters were somewhat different in their location. Relatively speaking, there were fewer adopting schools in more urban areas. For example, 65 non-adopting schools (10%) are located in a large central city such as Charlotte and 168 schools (25.9%) are mid-size city schools, located in cities like Fayetteville.

Table 2

Locale		Non adopting schools	Adopting Schools	Total
Large Central City	Count	65	19	84
	%	10.0%	3.4%	7.0%
Large Town	Count	2	9	11
	%	.3%	1.6%	.9%
Mid-Size City	Count	168	99	267
	%	25.9%	18.0%	22.3%
Rural, inside MSA	Count	109	137	246
	%	16.8%	24.9%	20.5%
Rural, outside MSA	Count	155	121	276
	%	23.9%	22.0%	23.0%
Small Town	Count	48	74	122
	%	7.4%	13.4%	10.2%
Urban Fringe of Large City	Count	30	12	42
	%	4.6%	2.2%	3.5%
Urban Fringe of Mid-Size City	Count	72	80	152
	%	11.1%	14.5%	12.7%
Total	Count	649	551	1200
	%	100.0%	100.0%	100.0%

We also compared the ethnic compositions of TM schools as compared to non-TM schools. We computed the percentage of white students in the school and found that, on average, TM schools had relatively fewer minority students (62% of students were white) than the non-TM schools (58% of students were white).

NCES data also provided information concerning the socio-economic status of students in the adopting and non-adopting schools. To compute the percent of students in poverty, the researcher sum the numbers of students in each category and then dividing by the number of students in the school. The resulting percentage ranged from 0 percent of students eligible to 100 percent. The mean percentages of students in poverty were equivalent in both groups (46% eligible for free or reduced-price lunch). Adopting schools were more likely to be Title I schools than were non-adopters. Fifty-two percent of TM schools were Title I schools as compared to 45% of non-TM schools.

Data

North Carolina implemented the ABCs accountability model in elementary and middle schools in 1996-97. In 1998-99, the state combined elementary, middle and high schools into one comprehensive ABCs model. This study used reading and mathematics scores from the North Carolina ABC statewide assessment to measure gains in achievement for schools from 1997 to 2002. The ABC data consist of the number of students in each grade level at four performance levels for each school. For example, School A enrolled 100 fifth graders and 10 students scored at the lowest level in mathematics; 30 at the second level; 40 at the third level (considered proficient); and 20 at the fourth and highest level. For each grade level and content area, we computed the percent of students at each performance level in each content area. So, for School A, the mathematics data for Grade 5 was 0.10 Level 1; 0.30 for Level 2; 0.40 Level 3; and 0.20 Level 4. The data were converted to

percentages to allow for comparisons between schools of different enrollments. The smallest school in this dataset enrolled only five students while the largest student body was 2414 students. The overall mean was 551 students in a building.

For each school and grade level included in the sample, there was a minimum of sixteen data points:

1. Percent of Students in Grade X[1] at Level 1 in Reading in 1997;
2. Percent of Students in Grade X at Level 2 in Reading in 1997;
3. Percent of Students in Grade X at Level 3 in Reading in 1997;
4. Percent of Students in Grade X at Level 4 in Reading in 1997;
5. Percent of Students in Grade X at Level 1 in Mathematics in 1997;
6. Percent of Students in Grade X at Level 2 in Mathematics in 1997;
7. Percent of Students in Grade X at Level 3 in Mathematics in 1997;
8. Percent of Students in Grade X at Level 4 in Mathematics in 1997
9. Percent of Students in Grade X at Level 1 in Reading in 2002;
10. Percent of Students in Grade X at Level 2 in Reading in 2002;
11. Percent of Students in Grade X at Level 3 in Reading in 2002;
12. Percent of Students in Grade X at Level 4 in Reading in 2002;
13. Percent of Students in Grade X at Level 1 in Mathematics in 2002;
14. Percent of Students in Grade X at Level 2 in Mathematics in 2002;
15. Percent of Students in Grade X at Level 3 in Mathematics in 2002;
16. Percent of Students in Grade X at Level 4 in Mathematics in 2002

The majority of schools included 3-6 grade levels. For example, a K-5 school would include four grade levels, Grades 3, 4, 5 and 6 and thus have 48 data points for reading and mathematics.

Analysis and Results

The data used in the analysis originated with the North Carolina Department of Public Instruction and NCES. We conducted the statistical analysis using SPSS Version 12. This is a dedicated statistical software package. For complementary presentations of data, especially graphs we used Excel.

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[1] Where X = first grade in school within target grade span (3-8)

The initial analysis compared the two groups of schools on the 1997 ABC data. An independent t-test tested the null hypotheses that there were no statistically significant differences between the two groups of schools. There were a number of significant differences between the two groups, but for the most part, the schools were reasonably comparable (See Appendix A for results). To ascertain the gain from 1997 to 2002, we conducted a one-way analysis of covariance for each performance level in each grade with the dichotomous independent variable of adopting/non-adopting, the 1997 percent of students at the specific performance level as the covariate, and the 2002 percent of students at that same performance level as the dependent variable. Unfortunately, these analyses did not show significant differences between Thinking Maps schools and comparison schools after controlling for the 1997 variance.

Because of the lack of significance in the ANCOVA, we tested the null hypothesis that there were no significant gains between 1997 and 2002 in Thinking Maps adopting schools. We used a dependent t-test to ascertain the degree to which TM schools had changed from 1997 to 2002. Appendix B includes the descriptive statistics and significance for the t-test.

Figure 1 illustrates the changes between 1997 and 2002 in reading for students in TM schools at the highest performance level in reading on the ABCs. As can be seen in the figure, third graders made the largest gain with only 28% scoring at the highest level of the l997 reading test and 40% scoring at that level in 2002.

Figure 1- Gains from 1997 to 2002 in reading

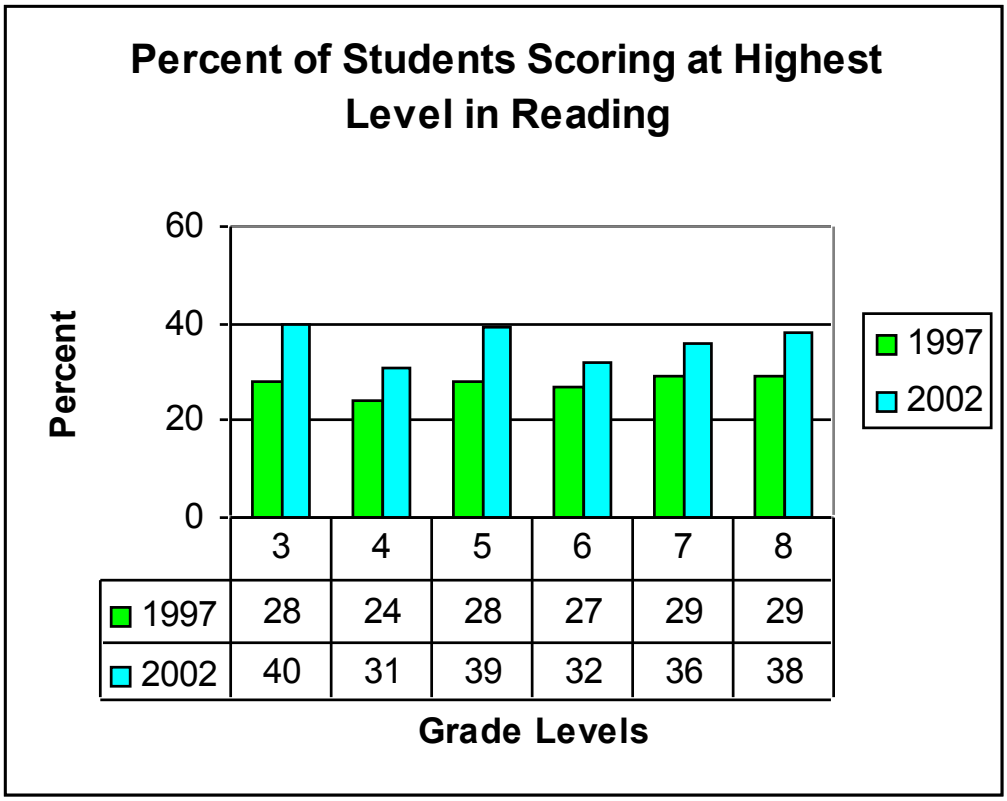
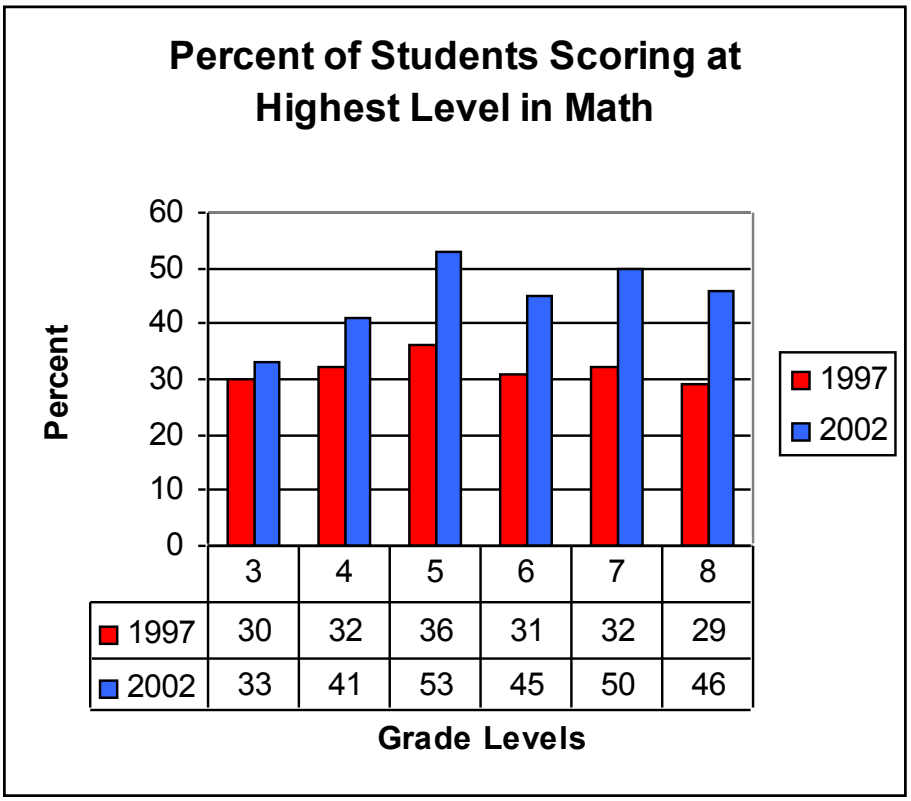


Figure 2 shows the same comparison for mathematics. As can be seen from this figure, there were on average some 36 percent of Grade 5 students scoring at the highest level in mathematics in 1997. In 2002, over half (53%) scored at that level. Although other interventions may account for some of these gains, it is clear that TM schools made significant strides in student achievement in the targeted years.

Figure 2



We also examined the changes in achievement among students at the lowest level of achievement on the ABCs measures have reading and mathematics. As Figure 3 illustrates, in 1997, 11 percent of Grade 3 students scored at the lowest performance level on the ABC test in reading. This percentage dropped significantly by 2002 when only four percent of the students in the same schools scored at the lowest level. Arguably, this is more important than the increases in Level 4 performance, as the students at-risk of academic failure are likely to score at this level on the ABCs tests.

Figure 3

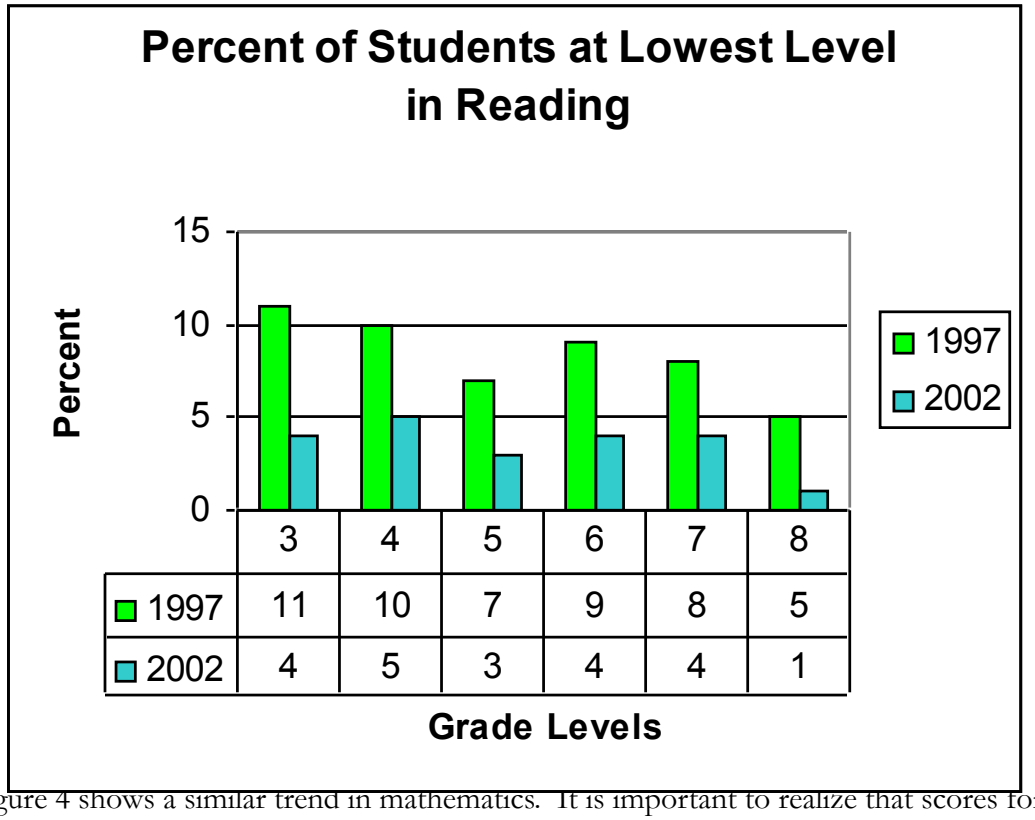
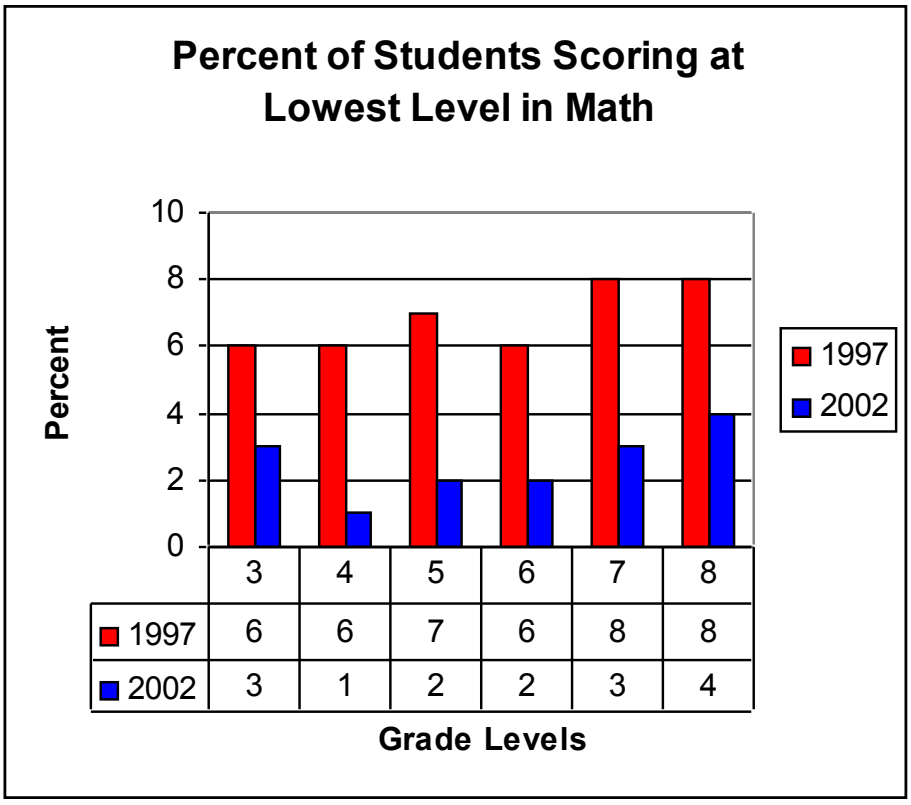


Figure 4 shows a similar trend in mathematics. It is important to realize that scores for each individual school were matched between 1997 and 2002 data.

Figure 4


Percent of Students Scoring at Lowest Level in Math
Percent
10
8
6
4
2
0
1997
2002
3 4 5 6 7 8
1997 6 6 7 6 8 8
2002 3 1 2 2 3 4
Grade Levels

Finally, students who were in Grade 3 in 1997 were in Grade 8 in 2002. Given the stability of North Carolina school populations, we examined these two sets of scores. Figure 5 shows this one cohort at the four performance levels in reading. As can be seen in this figure, the percent of students at the lowest two levels in 1997 significantly dropped by the time these students were in Grade 8. Additionally, the percent of students at the highest performance level increased significantly.

Figure 5

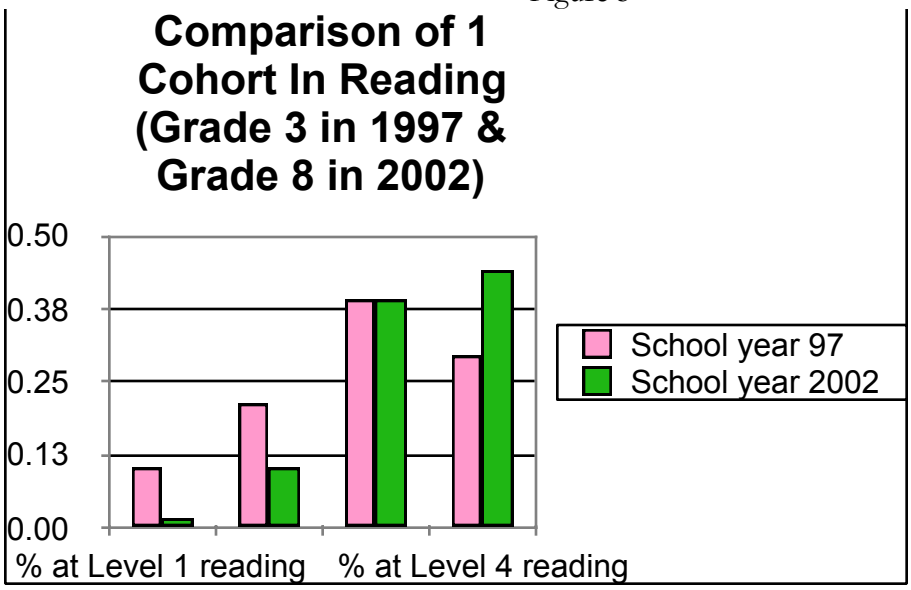
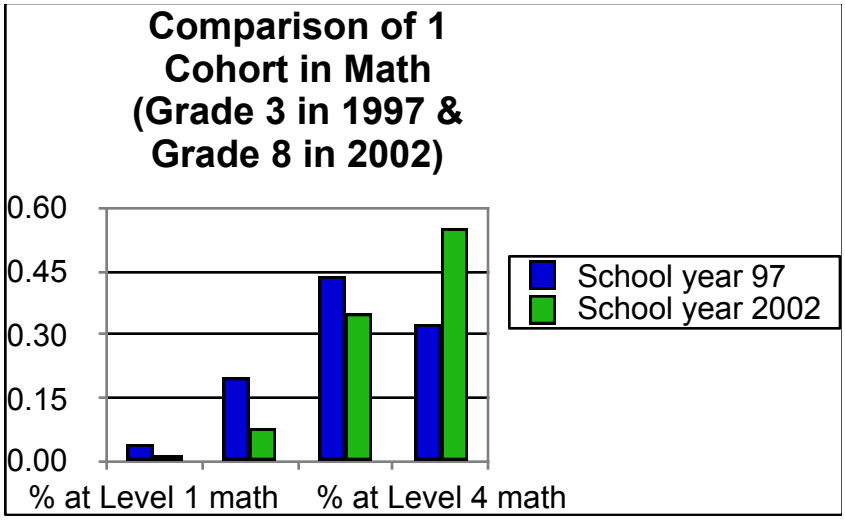


Figure 6



Again, the percentage of students at the lowest two performance levels decreased significantly while the percentage of students at Level 4 significantly increased.

Conclusions

It is clear that many schools that adopted Thinking Maps in the period from 1997 to 2002 experienced significant changes in student achievement in both reading and mathematics on the ABCs tests. However, it is important to acknowledge that the comparison schools also experienced gains. It is unlikely that the comparison schools employed any single intervention that is comparable to Thinking Maps. Some of these gains probably resulted from the increased emphasis on school accountability in North Carolina. In addition, it is impossible to estimate the number of TM schools that experienced a transient gain and then leveled off.

Future research should examine the degree of TM implementation in a school is related to gains over longer periods. For example, if all teachers in one school use TM every week, then it is important to know how much of a gain is achieved as compared to schools where fewer teachers employ the maps on a less regular basis. Other characteristics that might influence gains are the stability of school staff (both administration and faculty); the

quality of training initially and the extent of follow-up training; the use of TM software; and the implementation of Write from the Beginning.

The attitude of teachers in the classroom affects the efficacy of interventions like TM. If TM was mandated as an intervention by administration, it is possible that teachers will be less than enthusiastic about TM. Probably, TM has its greatest effect when teachers understand the program and regularly implement maps in various subject areas.

Appendix A – Comparison of 1997 Performance of Comparison and Thinking Maps Schools

	TM (0=No; 1=between 97 & 2002;	N	Mean	Std. Deviation
y97g3rl1pct	0	359	.1029	.07189
	1	349	.1082	.06818
y97g3rl2pct	0	359	.2218	.09297
	1	349	.2345	.08349
y97g3rl3pct	0	359	.3780	.08290
	1	349	.3791	.07083
y97g3rl4pct	0	359	.2974	.14368
	1	349	.2781	.11891
Grade 5	0	366	.4084	.08800
	1	351	.4256	.07286
y97g5rl2pct	0	366	.1984	.09168
	1	351	.2214	.08877
y97g5rl1pct	0	366	.0710	.07159
	1	351	.0730	.04941
y97g6rl1pct	0	269	.0823	.05668
	1	172	.0839	.04870
y97g6rl2pct	0	269	.2373	.10301
	1	172	.2543	.07817
y97g6rl3pct	0	269	.3774	.08616
	1	172	.3845	.06909
y97g6rl4pct	0	269	.3031	.12344
	1	172	.2772	.11124
y97g7rl1pct	0	227	.0782	.06433
	1	142	.0784	.04524
y97g7rl2pct	0	227	.2311	.09580
	1	142	.2458	.07315
y97g7rl3pct	0	227	.3655	.07596
	1	142	.3830	.06228
y97g7rl4pct	0	227	.3252	.13858
	1	142	.2928	.09950
y97g8rl1pct	0	226	.0481	.04650

	1	142	.0458	.02983
y97g8rl2pct	0	226	.1952	.10241
	1	142	.2014	.07631
y97g8rl3pct	0	226	.4379	.08984
	1	142	.4517	.05935
y97g8rl4pct	0	226	.3187	.13354
	1	142	.3011	.09928
y97g8ml4pct	0	226	.3177	.14832
	1	142	.2942	.11242
y97g8ml3pct	0	226	.3870	.08730
	1	142	.4072	.06715
y97g8ml2pct	0	226	.2103	.09443
	1	142	.2180	.07652
y97g8ml1pct	0	226	.0850	.07404
	1	142	.0805	.04838
y97g3ml1pct	0	359	.0677	.06595
	1	349	.0626	.05672
y97g3ml2pct	0	359	.2225	.11432
	1	349	.2292	.09481
y97g3ml3pct	0	359	.3914	.08867
	1	349	.4081	.07656
y97g3ml4pct	0	359	.3226	.15489
	1	349	.3019	.12978
y97g4ml4pct	0	364	.3515	.16060
	1	355	.3227	.13966
y97g4ml3pct	0	364	.4133	.09678
	1	355	.4268	.08234
y97g4ml2pct	0	364	.1791	.10240
	1	355	.1914	.08800
y97g4ml1pct	0	364	.0584	.05637
	1	355	.0606	.05320
y97g7ml1pct	0	227	.0843	.07011
	1	142	.0790	.04892
y97g7ml2pct	0	227	.1955	.09800

	1	142	.2075	.08148
y97g7ml3pct	0	227	.3643	.08150
	1	142	.3934	.07232
y97g7ml4pct	0	227	.3559	.15865
	1	142	.3202	.12563
y97g6ml4pct	0	269	.3318	.15864
	1	172	.3119	.14246
y97g6ml3pct	0	269	.4050	.09069
	1	172	.4232	.08296
y97g6ml2pct	0	269	.1982	.10173
	1	172	.2070	.09669
y97g6ml1pct	0	269	.0650	.05653
	1	172	.0578	.04110
y97g5ml1pct	0	366	.0655	.05886
	1	351	.0673	.05257
y97g5ml2pct	0	366	.1886	.10270
	1	351	.2005	.09095
y97g5ml3pct	0	366	.3549	.09330
	1	351	.3708	.07811
y97g5ml4pct	0	366	.3911	.16878
	1	351	.3614	.14565

Appendix B – Results of Dependent T-test for TM schools

		N	Mean	Std. Deviation	Significance of t
Pair 1	y97g8ml4pct	125	0.2941	0.11317	0.000
	y02g8ml4pct	125	0.4611	0.15022	
Pair 2	y97g8ml3pct	125	0.4055	0.06516	0.978
	y02g8ml3pct	125	0.3760	0.08391	
Pair 3	y97g8ml2pct	125	0.2190	0.07626	0.000
	y02g8ml2pct	125	0.1268	0.07044	
Pair 4	y97g8ml1pct	125	0.0814	0.05047	0.000
	y02g8ml1pct	125	0.0362	0.03041	
Pair 5	y02g7ml4pct	128	0.4953	0.14645	0.000
	y97g7ml4pct	128	0.3217	0.12752	
Pair 6	y02g7ml3pct	128	0.3442	0.08270	0.041
	y97g7ml3pct	128	0.3915	0.07265	
Pair 7	y02g7ml2pct	128	0.1351	0.07330	0.000
	y97g7ml2pct	128	0.2069	0.08195	
Pair 8	y02g7ml1pct	128	0.0254	0.02488	0.000
	y97g7ml1pct	128	0.0798	0.05052	
Pair 9	y02g6ml4pct	125	0.4506	0.15031	0.000
	y97g6ml4pct	125	0.3051	0.13036	
Pair 10	y02g6ml3pct	125	0.4156	0.08900	0.049
	y97g6ml3pct	125	0.4249	0.07658	
Pair 11	y02g6ml2pct	125	0.1134	0.07344	0.000
	y97g6ml2pct	125	0.2092	0.09090	
Pair 12	y02g6ml1pct	125	0.0203	0.02059	0.008
	y97g6ml1pct	125	0.0608	0.04343	
Pair 13	y02g5ml1pct	347	0.0165	0.02009	0.000
	y97g5ml1pct	347	0.0665	0.05145	
Pair 14	y02g5ml2pct	347	0.0948	0.06410	0.000
	y97g5ml2pct	347	0.2001	0.09057	
Pair 15	y02g5ml3pct	347	0.3629	0.11204	0.000
	y97g5ml3pct	347	0.3709	0.07811	
Pair 16	y02g5ml4pct	347	0.5258	0.16113	0.000
	y97g5ml4pct	347	0.3625	0.14547	

Pair 17	y97g4ml1pct	354	0.0605	0.05323	0.000
	y02g4ml1pct	354	0.0089	0.01425	
Pair 18	y97g4ml2pct	354	0.1911	0.08801	0.000
	y02g4ml2pct	354	0.1005	0.07196	
Pair 19	y97g4ml3pct	354	0.4269	0.08245	0.000
	y02g4ml3pct	354	0.4709	0.10758	
Pair 20	y97g4ml4pct	354	0.3230	0.13976	0.000
	y02g4ml4pct	354	0.4196	0.15376	
Pair 21	y97g3ml4pct	347	0.3020	0.13013	0.000
	y02g3ml4pct	347	0.3322	0.14741	
Pair 22	y97g3ml3pct	347	0.4077	0.07659	0.000
	y02g3ml3pct	347	0.4411	0.08831	
Pair 23	y97g3ml3pct	347	0.4077	0.07659	0.913
	y02g3ml2pct	347	0.2021	0.10406	
Pair 24	y97g3ml2pct	347	0.2294	0.09500	0.000
	y02g3ml2pct	347	0.2021	0.10406	
Pair 25	y97g3ml2pct	347	0.2294	0.09500	0.000
	y02g3ml2pct	347	0.2021	0.10406	
Pair 26	y97g3ml1pct	347	0.0627	0.05686	0.000
	y02g3ml1pct	347	0.0313	0.03752	