

Examination
of
Wrong-To-Right Erasures
at
Hapeville Charter Middle School

by

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Preface

The work reported here was based on records that were made available to me by the staff of Hapeville Charter Middle School, the staff of the Georgia Governor's Office of Student achievement which routed data through the Fulton County School System, and from various internet web sites bases provided by the Georgia Governor's Office of Student achievement, the Atlanta Journal Constitution, and the Georgia State Department of Education. The Georgia Governor's Office of Student achievement permitted examination of answer sheets at CTB/McGraw-Hill facilities in Indianapolis, Indiana, but restricted access both by limiting time to examine answer sheets and by not providing keys for the answer sheets that were examined. Data was also gathered by interviewing staff and teachers at Hapeville Charter Middle School.

Gathering information based on such procedures is subject to certain limitation. I was generally not the primary data collector. I can thus not always know of my own knowledge that I have the correct data, but must rely on data reported by others. Data was thus filtered through previous analysis, opinion, and other collection procedures. The time limitations at CTB/McGraw Hill were so restrictive that normal verification procedures were not possible. Thus in some cases I found myself unable to recount or reexamine when best practices would have mandated such recount or review to verify accuracy. Although I have tried to be as accurate as possible within these limitations, I would not be surprised if a worker with better access would find information that would differ from what I have found. I would not expect such differences to be large or to generally affect the conclusions presented here.

I would like to acknowledge the cooperation of teachers and staff at Hapeville Charter Middle School, and the Fulton County School System, who often interrupted other work to give answers, who provided data on short notice, and who were very cooperative. In addition the staff I met at CTB/McGraw-Hill were also kind and helpful within the imposed limitations.

Summary

The Georgia Governor's Office of Student Achievement authorized an erasure analysis of the Answer sheets of the 2009 CRCT tests. The number of Wrong-To-Right changes was recorded for each student. Four grade level means were found to be more than three standard deviations from the state mean. This was a flagging criterion and four of the nine tests were flagged, 44%. This resulted in a classification of "severe concern" for Hapeville Charter Middle School. An analysis of the data based on classrooms was performed and this analysis changed the proportion of classes flagged to eight out of 63, 12.1%, which was classified as "moderate concern."

Interviews with faculty and staff showed that access to the tests and answer sheets was likely easy for any faculty or staff member. An examination of the answer sheets showed that any changes were likely made in the answer sheets of 53 students for the 8th grade Mathematics test. Two patterns emerged in these answer sheets. First there were an unusual clustering of WTR changes in 5 items, second there were likely numerous cases where students had moved answers due to being out of place on the answer sheet. The unusual clustering is indicative of changed answers barring a different interpretation. Moving of answers was indicative of higher erasure counts without cheating.

Cheating by changing answers could have occurred because there was opportunity changing. There is also evidence to support that the changes were the result of normal student erasures. Without further evidence this report cannot definitively state what occurred.

Introduction

The Governor's Office of Student Achievement, GOSA, asked CTB/McGraw-Hill to conduct an erasure analysis on the Georgia Criterion-Referenced Competency Tests, CRCT, administered in the spring of 2009. The function of the erasure analysis is to indicate any unusual number of erasures that represent an incorrect answer erased and the item also answered correctly, the WTR count. It has been observed that a large number of WTR erasures often corresponds with and indicates cheating by changing wrong answers to right answers. GOSA described its procedures as follows

"In the analysis, CTB psychometricians scanned answer documents to identify total erasures per classroom, flagging those classrooms in which the number of wrong-to-right changes proved to be three standard deviations (SDs) or more above the state average. Less than 0.15% of test takers would be expected to fall in that range naturally. Based on the analysis, schools were placed in varying categories according to their percentage of flagged classrooms. 80% of Georgia's elementary and middle schools fell into the "Clear of Concern" category, meaning less than 6% of the classes within a given school were flagged; 10% fell into the "Minimal Concern" category with 6%-10% of classes flagged; 6% were determined to be in the "Moderate Concern" category with 11%-24% of classes flagged; and only 4% were termed "Severe Concern" as defined by a school having 25% or more of its classes flagged for wrong-to-right changes." ((Retrieved April 22, 2010 from http://public.doe.k12.ga.us/DMGetDocument.aspx/GOSA%20CRCT%20Analysis%20Report_3.1.2010.pdf?p=6CC6799F8C1371F6E8EF7082EB992B23516C27A28F7D821EBC2A0AAB1DA796EA&Type=D)

At Hapeville Charter Middle School, HCMS, GOSA's procedure flagged the 7th grade reading, 8th grade reading, 8th grade mathematics, and 8th grade English/Language Arts, as being severe. The sample size, n , mean number of erasures per student for Georgia, standard deviation for Georgia, the mean number of erasure for HCMS, and z values for these four areas are shown in Table 1.

Grade	Subject	n	Georgia mean	Georgia Standard Deviation	HCMS Mean	z
7	Reading	164	.81	1.27	1.21	4.06
8	Reading	148	.92	1.39	1.32	3.5
	Mathematics	148	1.54	2.14	4.13	14.7
	English	148	1.04	1.63	1.74	5.25

The state directions for turning in the test forms in the spring of 2009 were somewhat ambiguous and although most schools arranged the test answer sheets such that each classroom was analyzed separately, HCMS arranged the answer sheets such that an entire grade level was treated as a class, i.e. the unit of analysis was a grade level. The directions from Fulton County to the schools appear to permit this arrangement. Thus, the sample sizes reported in Table 1 are near 150 instead of the smaller sizes that might be expected as classroom sizes. There were three grade levels at HCMS in 2009 that combined with the 3 tests of concern, English, Mathematics, and Reading, to make 9 combinations of classes and subject areas. Thus 4 of the 9 combinations were flagged or 44.4%. GOSA characterized this level of flagging as "severe concern" and thus required the review of the 2009 testing at HCMS reported in this document. [The concern levels GOSA used are listed in Appendix A.]

An alternative to GOSA's Analysis for HCMS

If HCMS had arranged the tests such that each classroom was a unit of analysis, the results would have been as listed in Table 2. Counting the z values for the classes [not counting the two classes having only 1 member], there are 8 of 66, or 12.1%, z values greater than 3. These values are highlighted in yellow on the table. An expanded version of Table 2 may be found in Appendix B.

Table 2							
Classes Flagged at Hapeville Charter Middle School under Classroom Analysis							
Grade	Class	Means			z values		
		English	Mathematics	Reading	English	Mathematics	Reading
6	1	0.800	1.720	0.720	-.52	.74	-1.79
	2	1.208	1.875	1.500	.78	1.11	.12
	3	0.714	1.714	1.143	-.59	.54	-.56
	4	0.714	1.714	1.143	-.59	.54	-.56
	5	1.000	1.080	0.760	.13	-.89	-1.69
	6	0.846	1.154	0.769	-.37	-.72	-1.70
	7	0.815	1.407	1.000	-.49	-.06	-1.15
7	1	0.750	0.750	0.780	-.61	-1.41	-.13
	2	0.679	1.821	0.679	-.83	1.89	-.55
	3	1.500	0.500	0.500	0.56	-.55	-.35
	4	0.762	1.476	1.476	-.46	.74	2.40
	5	1.000	1.400	0.960	.30	.59	.59
	6	1.222	1.111	1.556	.63	-.13	1.76
	7	1.000	1.864	2.545	.29	1.79	6.41
	8	1.000	0.731	1.115	.31	-1.32	1.23
8	1	1.478	2.000	1.609	1.29	1.03	2.38
	2	4.190	6.000	2.670	8.86	9.55	5.77
	3	1.438	5.250	0.625	.98	6.93	-.85
	4	0.000	0.000	0.000			
	5	1.409	4.773	1.000	1.06	7.09	.27
	6	1.714	6.571	1.667	1.90	10.77	2.46
	7	1.474	3.842	1.000	1.16	4.69	.25
	8	0.720	1.560	0.960	-.98	.05	.14

This analysis classifies HCMS at GOSA's low end of moderate concern rather than at the severe concern that results when the grade level is interpreted as class rather than the classroom being interpreted as class and the resulting analysis is based on 9 z values rather than the 63 appropriate z values of Table 2. Since most schools and school systems arranged their answer sheet such that the classroom was the unit of analysis rather than a grade level, it seems appropriate that HCMS be examined using this same procedure used for the vast majority of Georgia schools and that the level of concern for HCMS is actually be moderate rather than severe.

Opportunity to Change Answers

Although the analysis based on classroom values as in Table 2 reduces the concerns from severe to moderate, concerns over the number of erasures do remain. Accordingly, all teachers acting as proctors and all administrative staff and the office manager were interviewed individually to determine the sequences of events during the testing time. Almost a year having passed since the 2009 Spring testing to the time of the interviews, no one interviewed would state an exact number of days that materials arrived before testing or an exact time after testing that Fulton County collected materials from HCMS. The following events were unanimously agreed upon by all those interviewed.

- Test booklets and answer sheets arrived some days before the tests were to begin and were stored in the counselor's suite.
- Due to some rearranging of classes between the time student names and classes information were sent for labeling answer sheets, grade level teams resorted the answer sheets into appropriate packages for distribution to the rearranged classes on the day before testing began.
- Test booklets and answer sheets were then locked in the counselor's suite and in a locked file cabinet in one teacher's classroom.
- Each day after testing test booklets and answer sheets were returned to these locked locations.
- At the end of testing test booklets and answer sheets were counted and packed for return to Fulton County.
- Fulton County picked up the test booklets and answer sheets after a few days.

The directions from Fulton County regarding how security was to be handled were followed in this sequence of events. However, there are several factors that make the security less than desirable:

- Storing the answer sheets and booklets in two places makes it easier for someone to obtain access to the materials

- Filing cabinets manufacturers are notorious for frequently using the same key for multiple cabinets. Thus, if one has a key to a particular brand of file cabinet, one can usually have access to most other cabinets of the same brand.
- The room in the counselor's suite where testing material was stored is an anteroom to the HCMS counselor's office and to the HCMS security officer's office. There is reason for students and staff to enter these rooms at most hours of the work day. Moreover, keys to the anteroom are possessed by many people: the principal, the school data analyst, the counselor, and the security guard. One might suspect that various other personnel probably also have keys to the room. Since the charter school is housed in an older church, there are likely many others with keys to the room. Teachers also often have access to each other's rooms. In addition, the school janitor has keys to all these rooms. When asked during the interviews of two teachers, "If you were here after hours and said to the janitor, 'I need to get into the counselor's suite; would you please let me in?'", both said the janitor would of course open the door for them. I take all this to mean that just about any staff member at HCMS had access to the testing materials after normal school hours.

The opportunity to change answers was thus widely available to school staff since any staff member would likely have had access to the answer sheets. (Upon a recommendation to change this, HCMS has selected a locked closet, to which only two people have a key, for storage this year.)

Preponderance of WTR Changes

Examination of Table 2 shows

- there were no flagged classes in the 6th grade.
- there was only one flagged class in the 7th grade for Reading.
- there were seven flagged classes in the 8th grade: one for English, one for Reading and five for Mathematics.
- one classroom was flagged for all three areas: English, Reading, and Mathematics.

Clearly the preponderance of flagged WTR changes occurred for 8th grade classes in Mathematics with additional flagging for English and Reading for one 8th grade class.

To understand what gives rise to the five flagged mathematics classes I looked at all those 8th grade students in flagged classes who made 5 or more WTR erasures on the Mathematics test. There were 53 such students who collectively made 441 WTR erasures. I determined to see what would have happened if these 53 students had each made the state mean number of 1.54 WTR erasures for a total of 82 erasures instead of 441. The resulting adjusted means and z values are shown in Table 3. None of the z values in Table 3 are greater than 3 and thus none of the classes would be flagged if these 53 students had made the average number of erasures.

Table 3								
Adjusted means and Z values for Flagged Classes								
Class	n with > 4 WTR Changes =n1	Total WTR Change s=c	state mean =sm	state standard deviatio n = sd	Original Mean =m1	number in class = n	Adjusted mean	Adjusted z
2	15	115	1.54	2.14	6.05	20	1.46	-0.18
3	9	73	1.54	2.14	5.25	16	1.55	0.03
5	11	87	1.54	2.14	4.773	22	1.59	0.11
6	12	121	1.54	2.14	6.571	21	1.69	0.32
7	6	45	1.54	2.14	3.842	19	1.96	0.86

$$\text{Adjusted mean} = (m1 * n - (c-n1*sm)) / n$$

$$\text{Adjusted z} = (\text{Adjusted Mean} - sm) / (sd / \sqrt{n})$$

This leads me to the supposition that if answers were changed, the changes occurred in the answer sheets of these 53 students.

Who are these 53 students? They include special education and English as a Second Language students, but neither of these groups predominates. Both Mathematics scale score for 2008 and 2009 were available for 50 of these 53 students who made five or more WTR erasures. The means for 2009 and 2008 were 811.86 and 812.74, respectively. A paired difference t-test showed no significant difference between the means($t = -.292$, $df = 49$, $P = .339$, two tailed). In fact the mean from the 2009 testing, when there is moderate concern over the schools testing, decreased slightly from the mean of the 2008 testing, when there was no concern. Of these 50 students who had data available for both years, 7 failed to meet standards in 2009 while 11 failed to meet standards in 2008 (i.e. had scale scores less than 800). Three students failed to meet standards for both years. A test for the difference in proportions of these 50 students failing to meet standards (7/50 or .14 vs 11/50 or .22) yielded $z = 1.04$, $P = .30$, indicating only random variation in the proportion failing to meet standards. Thus if someone was changing answers to improve the school's testing results over the previous year, there was no impact compared to the previous year test results for these 50 students. There is no impact on these students both in terms of the mean scale scores and in terms of the proportion of students meeting standards.

CTB-McGraw-Hill

The 2009 answer sheets are currently held by the California Test Bureau of McGraw-Hill, CTB, in Indianapolis, Indiana. I went to CTB and examined all the 7th and 8th grade answer sheets. Although CTB was cooperative and polite, GOSA had limited the time I could be there to eight hours. The clock started at 8:00 a.m. and stopped at 4:00 p.m. Any time spent outside the room for a restroom break or for lunch was included in the eight hours. GOSA also refused to provide to answer keys while examining the answer sheets. Thus any verification of the WTR erasures

was not possible; it was not possible to count any changes of right answers to wrong answers or wrong to wrong changes; nor was it possible to do any analysis that required knowledge of the correct answers.

Several things did emerge from the examination of the answer sheets. First the answer sheets were relatively clean. There were few stray marks and I found little doodling that students often do. There were of course variations in the marking, but in comparison with what I have seen in other testing situations, the marks were very uniform.

The item bubbling was neat and very uniform. This could be the result of the extensive training of students for the CRCT and other tests or it could be result of "cleaning" of the answer sheets that is required to be done by the examiner. Fulton County directions require the examiner to certify by signature on a checklist that among other duties the examiner has done the following:

"8. All student response booklets were inspected. Bubbling was darkened and erasures complete where needed, any stray marks were removed and any incomplete demographic information was completed." (From the Fulton County Schools "Test Coordinator Training Guide" often referenced as "The Blue Binder.")

Testing personnel often refer to these actions as "cleaning" the answer sheets. Such cleaning helps the subsequent scanning and scoring to go smoothly with fewer processing problems. Although examiners are required to perform this cleaning and to submit a signed checklist verifying these activities, no person interviewed would state that they had touched the answer sheets for this purpose. Instead, each person said that at the conclusion of testing, proctors walked through the room and instructed students to clean the answer sheets.

There were indications that students had marked items on the answer sheets as items to be examined later. This is a common practice, but is usually done in the examination book rather than on the answer sheet. For example several students had placed an X over several item numbers and had later erased this X. For some of these cases, the part of the X extending beyond the bubble was visible as the remainder of an erased line. It was a faint remainder. I suspect that in cases where the mark did not extend beyond the line, where the initial mark was made sufficiently light, or where the erasure just appeared as any other erasure I would not have noticed the erased mark. Most items did not have such X's for these students.

Another student circled item numbers on 22 items. Although the answers sheets were clean, there was evidence of partial marks in some bubbles. One bubble for a c response had a c written in the bubble.

Another observation is that some pencil lead appeared to be spread by wiping. When most of us erase something we leave behind various darkened bits of the eraser that form a little bit of grime around the erasure. We typically brush that off with a flicking motion that causes the outside of the little finger to wipe across the erased spot. If there is sufficient pencil lead left on the erased item or, perhaps more pertinent to this review, if there is sufficient lead nearby, we can wipe some of that lead into an extended mark. I observed such a wiping of lead onto other bubbles in several cases. This wiping of lead can occur without a nearby erasure if the marks are made sufficiently dark.

For students with large number of erasures, I recorded the item numbers that had erasures.

Appendix C shows the erasures in a rectangular display. Note that all erasures are shown, not just

WTR erasures. In the body of the displays of Appendix C each column represents a person. In each columns the item numbers for the items in the test are listed in each column. Where an item had an erasure, the item is highlighted in yellow. I numbered the columns at the top, listed the total number of erasures for each item at the right of the body and the total number of erasures for each student at the bottom.

Two observations may be made by inspecting Appendix C .

The first observation comes from looking at items 13 through 17 across all students. There is a suspicious clustering of erasures across these items. This clustering raises several questions? Why did students make so many erasures here, were these 5 items particularly hard so that students could not make up their minds about these items? Did someone erase the students answers to these items and substitute another answer? Did all these students mark the correct answer to these items? (Some of these and other questions could have been answered if GOSA had provided the key to the tests.)

The second observation comes from examining the column for the second student where a string of erasures starts at item 40 and continues through item 69 with no erasures on 6 of the items included items. This is a pattern that is observed when a student discovers that s/he has been recording answers one or more items out of place and moves the answers to the correct positions. For example this pattern might occur if at item 70 the student realized there was a test item left, but there was not going to be any place to answer that item because the student had already bubbled an answer for item 70. The student would then go back to where the initial error in answering was and erase each item and move the result to the previous item. In this case , the student might have transferred answers from item 40 to item 70. The 6 skipped erasures could

have resulted because those positions happened to have the same answer so that erasing was not necessary or if an erasure occurred, the new answer went into the erased position and thus the erasure cannot be seen.

This result of a student realizing that answers had been bubbled into the wrong positions, could explain similar pattern in for the other students who had high number of erasures on other tests. In Appendix C examination of erasures for the following students and items will show a similar pattern. Table 4 lists 7 such students included in the 7th grade Reading, 8th grade English and 8th grade Reading tests. There are other patterns where the same moved item pattern could be responsible for the erasures, but those listed in Table 4 are the longest patterns. It is thus likely that some of the WTR erasure count comes from moving answers due to students finding themselves out of position on the answer sheets.

A third observation is the somewhat strange order of the answer sheets at CTB. Answer sheets are normally gathered in a classroom and placed in a stack in such an order. That typically means that all the answer sheets from a classroom are together in the stack. CTB maintains the answer sheets in the order they are received. When I was examining the answer sheets I was watched to see that I did not disturb the order of the sheets. The answers sheets at CTB were out of order with 6 answer sheets not with the remainder of their class.

Table 4			
Students in Appendix C whose patterns of erasures Indicates moved responses			
Grade	Test	Student	items
7	Reading	2	7 - 15
		13	41-49
		18	26-37
8	English	7	35-44
		8	13-28
8	Reading	5	1-14
		7	1-15

Can Conclusions be made

The basic question that this review would like to answer is did cheating take place by the changing of student answers on the answer sheets of the 2009 CRCT testing. Short of pictures, admissions of responsibility, or other criteria that are unavailable to the author, that question cannot be answered. The data obtained give a mixed picture. By the description of the testing process and particularly with respect to test security, it is clear that many teachers and staff members of HCMS had access to the answer sheets and could have changed answers. It is also clear that by GOSA's analysis an unusual number of erasures took place at HCMS. Yet, GOSA's own analysis is somewhat flawed. The most obvious flaw is permitting the analysis of divergent class sizes. HCMS arranged the answer sheets such that the z values were calculated based on

the entire grade level for each test while the typical school or school system arranged the answer sheets such that the z values were calculated based on a classroom. Georgia classrooms vary considerable in size with typical sizes in the low 20's. The sizes of the three grades on which the analysis for HCMS was based were 168, 165, and 148 for the 6th, 7th, and 8th grades, respectively. For a given real difference, that is if the real difference from the state mean were the same for both classroom, larger classrooms have a greater probability of being tagged than smaller classrooms. As previous analysis has shown, by GOSA's own rules, HCMS should not have been classified as severe concern. The flaws in GOSA's analysis, lead to the question of whether HCMS or any school should have been classified as of severe concern.

If we excuse the difficulties of the analysis, some serious questions arise: What does the erasure pattern for the students with high numbers of erasures on items 13 through 17 of the Mathematics test imply? Are these difficult or perhaps poorly worded items that lead to student confusion and thus erasures? What is the item difficulty of these items? Did these students get these items correct? Did all these students get these items correct? The answers to these questions could lead to some conclusions. Other areas of concern are the availability of the testing materials to so many teachers and staff at the school. These two facts (1. Many teachers and staff had access to the testing materials 2. There is a suspicious pattern of erasures for items 13 through 17 on the mathematics test for the students with high numbers of erasures.) support the conclusion that answers were changed.

The counters to changed answers are many. First there is GOSA's methodology that is dated and incomplete. GOSA had not even provided a statewide analysis of WTR erasures, let alone any

breakdown by school size, geographic region, ethnicity, social economic background, or any other factor that might affect how often students erase answers. Second, there is the evidence that if answers were changed, the impact on the meets objectives classification for HCMS students is either negative or so small as to be attributable to random variation. These two evidences support the conclusions that 1. We don't really know if anything unusual happened at HCMS. and 2. If something unusual did happen, it had little to no effect on the analysis of meeting objective at HCMS.

Whether there was cheating by changing of answers at Hapeville Charter Middle School awaits further and better evidence than available for this review.

Appendix A
GOSA Levels of Concern

GOSA characterized the degree of concern based on what percent of the z tests flagged the testing. Testing was flagged when the z value was greater than 3. Schools were then classified as to level of concern according to the per cent of flagged classes as:

- 0 - 5% Clear
- 6 - 10% Minimal concern
- 11- 24% Moderate concern
- ≥ 25% Severe concern

Appendix B

Expansion of Table 2 with values necessary for calculations.

Expansion of Table 2								
Classes Flagged at Hapeville Charter Middle School under Classroom Analysis *								
Grade	class		eng	math	read	z eng	z math	z read
6	1	Mean	0.800	1.720	0.720	-.52	.74	-1.79
		N	25.000	25.000	25.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	1.384	1.568	0.891			
	2	Mean	1.208	1.875	1.500	.78	1.11	.12
		N	24.000	24.000	24.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	1.382	2.112	2.341			
3	Mean	0.444	1.704	1.074	-1.73	.73	-.96	
	N	27.000	27.000	27.000				
	state mean	0.960	1.430	1.450				
	state stdv	1.550	1.960	2.040				
	Std. Deviation	0.801	1.564	1.492				
4	Mean	Mean	0.714	1.714	1.143	-.59	.54	-.56
		N	14.000	14.000	14.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	0.825	1.858	1.027			
	5	Mean	1.000	1.080	0.760	.13	-.89	-1.69
		N	25.000	25.000	25.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	1.414	1.256	1.234			
6	Mean	0.846	1.154	0.769	-.37	-.72	-1.70	
	N	26.000	26.000	26.000				
	state mean	0.960	1.430	1.450				
	state stdv	1.550	1.960	2.040				
	Std. Deviation	1.084	1.377	0.815				

	7	Mean	0.815	1.407	1.000	-.49	-.06	-1.15
		N	27.000	27.000	27.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	0.962	1.647	1.494			
	Total	Mean	0.833	1.506	0.982	-1.06	.50	-2.97
		N	168.000	168.000	168.000			
		state mean	0.960	1.430	1.450			
		state stdv	1.550	1.960	2.040			
		Std. Deviation	1.162	1.623	1.425			

7	1	Mean	0.840	0.680	0.800	-.24	-1.44	-.04
		N	25.000	25.000	25.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.463	0.945	1.443			
	2	Mean	0.679	1.821	0.679	-.83	1.89	-.55
		N	28.000	28.000	28.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.020	2.294	1.249			
	3	Mean	3.000	0.000	1.000	1.41	-.67	.15
		N	1.000	1.000	1.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	.	.	.			
	4	Mean	0.762	1.476	1.476	-.46	.74	2.40
		N	21.000	21.000	21.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.091	1.601	1.327			
	5	Mean	1.000	1.400	0.960	.30	.59	.59
		N	25.000	25.000	25.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.258	1.354	1.020			
	6	Mean	1.222	1.111	1.556	.63	-.13	1.76
		N	9.000	9.000	9.000			
		state mean	0.910	1.190	0.810			
state stdv		1.480	1.770	1.270				
Std. Deviation		1.202	1.965	1.944				
7	Mean	1.000	1.864	2.545	.29	1.79	6.41	
	N	22.000	22.000	22.000				
	state mean	0.910	1.190	0.810				
	state	1.480	1.770	1.270				

		stdv						
		Std. Deviation	1.604	1.959	3.348			
8		Mean	1.000	0.731	1.115	.31	-1.32	1.23
		N	26.000	26.000	26.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.200	1.116	1.306			
9		Mean	0.375	1.000	0.625	-1.02	-.30	-.41
		N	8.000	8.000	8.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	0.744	0.926	0.744			
Total		Mean	0.885	1.285	1.206	-.22	.69	4.01
		N	165.000	165	165.000			
		state mean	0.910	1.190	0.810			
		state stdv	1.480	1.770	1.270			
		Std. Deviation	1.251	1.645	1.786			

8	1	Mean	1.478	2.000	1.609	1.29	1.03	2.38
		N	23.000	23.000	23.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	2.042	1.834	1.196			
	2	Mean	4.050	6.050	2.650	8.26	9.42	5.57
		N	20.000	20.000	20.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	2.114	3.804	2.601			
	3	Mean	1.438	5.250	0.625	.98	6.93	-.85
		N	16.000	16.000	16.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	2.220	3.924	0.806			
	4	Mean	0.000	0.000	0.000	-.64	-.72	-.66
		N	1.000	1.000	1.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	.	.	.			
	5	Mean	1.409	4.773	1.000	1.06	7.09	.27
		N	22.000	22.000	22.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	1.764	3.866	1.069			
	6	Mean	1.714	6.571	1.667	1.90	10.77	2.46
		N	21.000	21.000	21.000			
		state mean	1.040	1.540	0.920			
state stdv		1.630	2.140	1.390				
Std. Deviation		1.765	4.812	1.683				
7	Mean	1.474	3.842	1.000	1.16	4.69	.25	
	N	19.000	19.000	19.000				
	state mean	1.040	1.540	0.920				
	state	1.630	2.140	1.390				

		stdv						
		Std. Deviation	1.982	3.149	1.155			
	8	Mean	0.720	1.560	0.960	-.98	.05	.14
		N	25.000	25.000	25.000			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	1.242	1.873	0.978			
	9	Mean	7.000	5.000	3.000	3.66**	1.62	1.50
		N	1.000	1.000	1.000			
			1.040	1.540	0.920			
			1.630	2.140	1.390			
		Std. Deviation	.	.	.			
	Total	Mean	1.743	4.128	1.372	5.25	14.71	3.95
		N	148	148	148			
		state mean	1.040	1.540	0.920			
		state stdv	1.630	2.140	1.390			
		Std. Deviation	2.113	3.812	1.557			

*Flagged classrooms, those with $z > 3$, are highlighted in yellow. Totals are not flagged, but are shown only to show that calculations agree with GOSA calculations.

** This value is not included in the counts since it is based only on one student.

Appendix C

Total Item Erasures for Selected Students*

*Students are numbered across the tops of the display.

Item numbers are listed vertically under the student numbering.

Items with observed erasures are highlighted in yellow.

The total number of erasures for a student is listed at the bottom of each display.

The total number of erasures for an item is listed at the right of the display

Selected 7th Grade Erasures in Reading

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	1
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	0
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	1
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	0
11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	5
12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	2
13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	2
14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	2
15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	5
16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	3
17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	1
18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	1
19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	3
20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	2
21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	21	2
22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	3
23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	6
24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	4
25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	1
26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26	5
27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	27	4
28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	5
29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	29	3
30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	5
31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	10
32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	4
33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	4
34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	34	3
35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	1
36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	4
37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	2
38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	3
39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39	2
40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	4
41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	41	6
42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	42	3
43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	4
44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	4
45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	4
46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	46	4
47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	47	1
48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	3
49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	1
50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	0
4	6	6	6	13	3	11	3	8	6	9	4	10	4	4	10	3	14	7	13	3	

Selected 8th Grade Erasures in English

1	2	3	4	5	6	7	8	9	
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	1
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	4
6	6	6	6	6	6	6	6	6	0
7	7	7	7	7	7	7	7	7	1
8	8	8	8	8	8	8	8	8	1
9	9	9	9	9	9	9	9	9	1
10	10	10	10	10	10	10	10	10	0
11	11	11	11	11	11	11	11	11	2
12	12	12	12	12	12	12	12	12	1
13	13	13	13	13	13	13	13	13	2
14	14	14	14	14	14	14	14	14	1
15	15	15	15	15	15	15	15	15	1
16	16	16	16	16	16	16	16	16	1
17	17	17	17	17	17	17	17	17	0
18	18	18	18	18	18	18	18	18	0
19	19	19	19	19	19	19	19	19	3
20	20	20	20	20	20	20	20	20	4
21	21	21	21	21	21	21	21	21	1
22	22	22	22	22	22	22	22	22	2
23	23	23	23	23	23	23	23	23	1
24	24	24	24	24	24	24	24	24	2
25	25	25	25	25	25	25	25	25	2
26	26	26	26	26	26	26	26	26	2
27	27	27	27	27	27	27	27	27	1
28	28	28	28	28	28	28	28	28	2
29	29	29	29	29	29	29	29	29	1
30	30	30	30	30	30	30	30	30	2
31	31	31	31	31	31	31	31	31	2
32	32	32	32	32	32	32	32	32	0
33	33	33	33	33	33	33	33	33	0
34	34	34	34	34	34	34	34	34	0
35	35	35	35	35	35	35	35	35	2
36	36	36	36	36	36	36	36	36	1
37	37	37	37	37	37	37	37	37	1
38	38	38	38	38	38	38	38	38	0
39	39	39	39	39	39	39	39	39	3
40	40	40	40	40	40	40	40	40	2
41	41	41	41	41	41	41	41	41	1
42	42	42	42	42	42	42	42	42	2
43	43	43	43	43	43	43	43	43	1
44	44	44	44	44	44	44	44	44	2
45	45	45	45	45	45	45	45	45	0
46	46	46	46	46	46	46	46	46	0
47	47	47	47	47	47	47	47	47	1
48	48	48	48	48	48	48	48	48	0
49	49	49	49	49	49	49	49	49	0
50	50	50	50	50	50	50	50	50	0
51	51	51	51	51	51	51	51	51	0
52	52	52	52	52	52	52	52	52	0
53	53	53	53	53	53	53	53	53	0
54	54	54	54	54	54	54	54	54	0
55	55	55	55	55	55	55	55	55	0
56	56	56	56	56	56	56	56	56	2
57	57	57	57	57	57	57	57	57	2
58	58	58	58	58	58	58	58	58	1
59	59	59	59	59	59	59	59	59	0
60	60	60	60	60	60	60	60	60	0
9	3	3	8	6	5	9	15	10	

68
69
70
10 26 7 5 7 6 9 14 23 13 20 17 9 13 9 19 6 11 7 9 14 11 9 10 11

Selected 8th Grade Erasures in Reading

1	2	3	4	5	6	7	8	8
1	1	1	1	1	1	1	1	3
2	2	2	2	2	2	2	2	4
3	3	3	3	3	3	3	3	1
4	4	4	4	4	4	4	4	2
5	5	5	5	5	5	5	5	1
6	6	6	6	6	6	6	6	2
7	7	7	7	7	7	7	7	1
8	8	8	8	8	8	8	8	2
9	9	9	9	9	9	9	9	3
10	10	10	10	10	10	10	10	2
11	11	11	11	11	11	11	11	2
12	12	12	12	12	12	12	12	5
13	13	13	13	13	13	13	13	0
14	14	14	14	14	14	14	14	2
15	15	15	15	15	15	15	15	1
16	16	16	16	16	16	16	16	0
17	17	17	17	17	17	17	17	2
18	18	18	18	18	18	18	18	0
19	19	19	19	19	19	19	19	0
20	20	20	20	20	20	20	20	3
21	21	21	21	21	21	21	21	1
22	22	22	22	22	22	22	22	0
23	23	23	23	23	23	23	23	1
24	24	24	24	24	24	24	24	0
25	25	25	25	25	25	25	25	0
26	26	26	26	26	26	26	26	0
27	27	27	27	27	27	27	27	1
28	28	28	28	28	28	28	28	0
29	29	29	29	29	29	29	29	1
30	30	30	30	30	30	30	30	0
31	31	31	31	31	31	31	31	0
32	32	32	32	32	32	32	32	1
33	33	33	33	33	33	33	33	0
34	34	34	34	34	34	34	34	1
35	35	35	35	35	35	35	35	1
36	36	36	36	36	36	36	36	2
37	37	37	37	37	37	37	37	0
38	38	38	38	38	38	38	38	1
39	39	39	39	39	39	39	39	0
40	40	40	40	40	40	40	40	0
41	41	41	41	41	41	41	41	1
42	42	42	42	42	42	42	42	1
43	43	43	43	43	43	43	43	1
44	44	44	44	44	44	44	44	1
45	45	45	45	45	45	45	45	1
46	46	46	46	46	46	46	46	0
47	47	47	47	47	47	47	47	2
48	48	48	48	48	48	48	48	3
49	49	49	49	49	49	49	49	2
50	50	50	50	50	50	50	50	1
3	4	4	6	11	5	18	6	