

Comparison of I Can Learn[®] and Traditionally-Taught 8th Grade Student Performance on the Georgia Criterion-Referenced Competency Test

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Intervention

I Can Learn[®] is a computerized mathematics software solution, specializing in Algebra and pre-Algebra. Aligned to state and national mathematics standards, it presents and assesses content in an interactive learning environment. The teacher in an I Can Learn[®] classroom is the facilitator of instruction, providing individual, small-group, or whole-class instruction as needed. The “Classroom Explorer” is a class management/gradebook system that provides real-time feedback on student progress. Teachers use the Classroom Explorer to determine which students need additional assistance with any given concept.

I Can Learn[®] is intended to be used as the primary system of instructional delivery-- not as a supplemental or resource tool. I Can Learn[®] consists of 303 lessons from basic mathematics to advanced Algebra concepts. With the help of education service specialists, teachers choose the lessons that align to their local curriculum needs. Each lesson includes a pretest, presentation in a real-world context, guided practice, individual practice, and a posttest. Problem-solving skills also are strengthened with challenging “journal” problems that require writing in math while solving multi-step application problems. Complete information about the system is available at www.icanlearn.com.

Sample

Gilmer County is a district in northwestern Georgia with a population of 25,000 and annual per capita income of \$17,315 (www.gilmerchamber.com/demographics.htm). Gilmer Middle School serves about 900 students in grades 6 through 8. In August 2001, I Can Learn[®] was introduced into 8th grade math classes at Gilmer. This evaluation is based on eighth grade students in the 2003-2004 school year who were assigned to either a traditionally-taught or I Can Learn[®] classroom based on a stratified random assignment process. Teachers used the students’ 7th grade math performance levels to classify students as high, average, or low in math achievement. Once students were stratified based on prior year achievement, they were randomly assigned to I Can Learn[®] or traditional classes. Thus, approximately equal proportions of students of each achievement level would be in the treatment and control groups.

Because only one teacher was certified to teach gifted math, she was assigned all gifted students. The I Can Learn[®] teacher had only two years teaching experience. She was trained to use the computer classroom the prior year. No students classified to receive special education services were assigned to I Can Learn[®] classes. Because all special education and all gifted students were assigned to traditional classes, their scores are not considered in any analyses. Although natural student groups were used, this may also be considered an advantage in terms of external validity in that the setting was not contrived.

The students included in this study consist of all 8th grade students at Gilmer Middle School not classified to receive gifted or other special education services. Tables 1, 2, and 3 describe the demographics of the treatment (I Can Learn[®]) and control (traditionally-taught) groups.

Table 1
Student Gender by Class Type

<u>Gender</u>		<u>Class Type</u>		<u>Total</u>
		<u>Traditional</u>	<u>I Can Learn</u>	
Female	Count	79	50	129
	% within class type	48.5%	54.9%	50.8%
Male	Count	84	41	125
	% within class type	51.5%	45.1%	49.2%
Total	Count	163	91	254
	% within class type	100.0%	100.0%	100.0%

Chi square=0.981; p=0.322

Table 2
Ethnicity by Class Type

<u>Ethnicity</u>		<u>Class Type</u>		<u>Total</u>
		<u>Traditional</u>	<u>I Can Learn</u>	
African Am	Count	1		1
	% within class type	.6%		.4%
Hispanic	Count	13	5	18
	% within class type	8.1%	5.5%	7.1%
White	Count	147	86	233
	% within class type	91.3%	94.5%	92.5%
	Count	161	91	252
	% within class type	100.0%	100.0%	100.0%

Chi square=2.301; p=0.512

Table 3
Lunch Status by Class Type

		<u>Class Type</u>		<u>Total</u>
		<u>Traditional</u>	<u>I Can Learn</u>	
Free lunch	Count	61	30	91
	% within class type	37.4%	33.0%	35.8%
Reduced lunch	Count	21	7	28
	% within class type	12.9%	7.7%	11.0%
Paid lunch	Count	81	54	135
	% within class type	49.7%	59.3%	53.1%
Total	Count	163	91	254
	% within class type	100.0%	100.0%	100.0%

Chi square=2.774; p=0.250

None of the *Chi squares* was significant at the $p < .05$ level, indicating that none of the demographic variables was significantly related to group assignment. Given that the participants were randomly assigned to groups, this finding is as expected.

Dependent Measure: Georgia Criterion Referenced Competency Test (GCRCT)

The GCRCT math test was implemented in Georgia in 2000 in grades 4, 6, and 8. Grades 1, 2, 3, 5, and 7 were added in 2002. The test was designed to assess how well students acquire the skills and knowledge described in the Georgia standards, the Quality Core Curriculum. The math test consists of 60 items in seven sub-parts-- Number Sense and Numeration, Geometry and Measurement, Patterns and Relationships/Algebra, Statistics and Probability, Computation and Estimation, and Problem Solving. The Georgia Department of Education offers claims of validity and reliability but does not offer specific technical information (<http://www.doe.k12.ga.us/curriculum/testing/crcr.asp>). Scale scores for the math test range from 150 to 450. Scores that are at or above 350 indicate a level of performance that exceeds the standard for the state test; scores from 300 to 349 indicate a level of performance that meets the standard; and scores below 300 indicate a level of performance that does not meet the standard.

Results

The GCRCT 2004 math scale score and each of the math subscale scores was compared for the I CAN Learn[®] and traditionally-taught students. Means and standard deviations of the two groups were used to compute effect sizes (see Table 4).

Table 4
Descriptive Statistics and Effect Sizes

	Class type	N	Mean	Std. Deviation	Std. Error Mean	Effect size*
Total	Control	163	319.8896	31.7261	2.4850	.43
	I CAN Learn	91	333.5385	35.7222	3.7447	
Number Sense	Control	163	325.3129	42.6130	3.3377	.45
	I CAN Learn	91	344.4945	38.6340	4.0499	
Geometry & Measurement	Control	163	321.0920	35.7211	2.7979	.17
	I CAN Learn	91	327.2857	38.0965	3.9936	
Patterns & Relationships	Control	163	323.4785	42.5380	3.3318	.33
	I CAN Learn	91	337.7033	41.9681	4.3995	
Statistics & Probability	Control	163	314.5767	32.6874	2.5603	.39
	I CAN Learn	91	327.3407	36.1255	3.7870	
Computation & Estimation	Control	163	321.4908	38.9755	3.0528	.44
	I CAN Learn	91	338.7692	37.6806	3.9500	
Problem Solving	Control	163	319.6380	37.8898	2.9678	.30
	I CAN Learn	91	330.9780	42.4952	4.4547	

*(treatment mean – control mean)/control SD

As shown, all means were higher for the I CAN Learn[®] group. To determine whether the differences were statistically significant, a .05 probability level was chosen and a multivariate analysis of variance (MANOVA) was used to compare the groups. The decision to use MANOVA was made because of the number of dependent variables being compared. Follow-up *t*-tests were used after finding a significant MANOVA (Wilk's lambda = .926; $F_{(df=7)}=2.826$; $p=.008$). The *t*-test results are presented in Table 5. Note

that the assumption of homogeneity of variance was met in all cases (see Levene's test results in Table 5).

Table 5
t-tests of Mean Differences Between *I CAN Learn*[®] and Traditional Classes by GCRCT Math Scale

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Total	.283	.595	Equal variances assumed	252	.002	-13.6489	4.3456	-22.2072	-5.0905
			not assumed	168.559	.003	-13.6489	4.4942	-22.5211	-4.7767
Number Sense	.600	.439	Equal variances assumed	252	.000	-19.1816	5.3961	-29.8088	-8.5544
			not assumed	202.004	.000	-19.1816	5.2481	-29.5297	-8.8336
Geometry & Meas	1.308	.254	Equal variances assumed	252	.197	-6.1937	4.7877	-15.6228	3.2354
			not assumed	176.420	.206	-6.1937	4.8762	-15.8168	3.4294
Patterns & Relation.	.004	.947	Equal variances assumed	252	.011	-14.2248	5.5399	-25.1353	-3.3143
			not assumed	188.412	.011	-14.2248	5.5187	-25.1112	-3.3383
Statistics & Probab.	.131	.718	Equal variances assumed	252	.004	-12.7640	4.4433	-21.5148	-4.0132
			not assumed	171.205	.006	-12.7640	4.5712	-21.7872	-3.7407
Computation & Estim.	.223	.637	Equal variances assumed	252	.001	-17.2784	5.0404	-27.2051	-7.3517
			not assumed	191.641	.001	-17.2784	4.9922	-27.1251	-7.4317
Problem Solving	.825	.365	Equal variances assumed	252	.030	-11.3400	5.1815	-21.5445	-1.1354
			not assumed	169.112	.036	-11.3400	5.3528	-21.9068	-.7731

As shown in Table 5, all mean differences were statistically significant except Geometry and Measurement. Figure 1 graphically depicts the results.

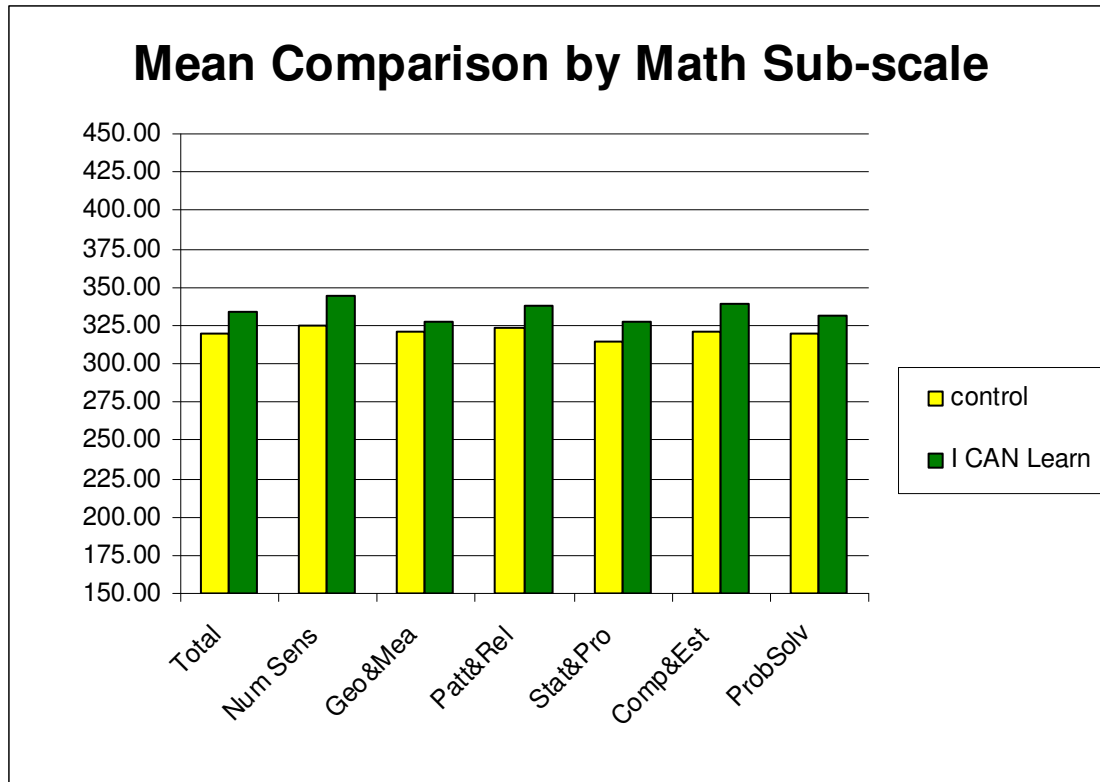


Figure 1. Scale score means by group

Results by Student Sub-groups

Data were disaggregated by gender, ethnicity, and lunch status to determine the effects of the treatment on important student subgroups.

Gender. Although females scored higher (mean=329.836) than males (mean=323.920) overall, the difference was not statistically significant and the treatment was effective for both groups. This conclusion is based on a two-way analysis of variance with gender and class type as the two independent variables. See Tables 6 and 7.

Table 6
Mean Scale Scores by Gender and Class Type

Gender	Class Type	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Female	Traditional	327.152	3.695	319.874	334.430
	I CAN Learn	332.520	4.645	323.372	341.668
Male	Traditional	313.060	3.584	306.001	320.118
	I CAN Learn	334.780	5.130	324.678	344.883

Table 7
ANOVA Summary Table for Effect of Class Type and Gender on GCRCT Math Total

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	19079.270	3	6359.757	5.895	.001
Intercept	24793433.246	1	24793433.246	22981.875	.000
GENDER	2030.268	1	2030.268	1.882	.171
Class Type	10642.249	1	10642.249	9.865	.002
GENDER * Class Type	3878.224	1	3878.224	3.595	.059
Error	269706.384	250	1078.826		
Total	27081148.000	254			
Corrected Total	288785.654	253			

a R Squared = .066 (Adjusted R Squared = .055)

Class type was statistically significant but gender was not nor was the interaction between the two variables. Thus, I CAN Learn[®] was effective for both male and female students.

Ethnicity. Because there are few non-white students in Gilmer Middle School, comparisons within ethnic subgroups may not be generalizable to minority students. The mean scale score for white students in the traditional group was 323.00 (SD=30.52); the mean for I CAN Learn[®] students was 332.45 (SD=34.70). The difference was statistically significant ($t=2.168$; $p=.03$). The effect size for white students is .31.

There were only 18 Hispanic students in the sample—5 in the I CAN Learn[®] classes and 13 in the traditional classes. Due to the small sample size, caution should be used in interpreting the findings regarding this subgroup. Hispanic students in the I CAN Learn[®] group scored on average 352.20 (SD=51.56); Hispanic students in the traditional classes averaged 288.69 (SD=25.37). A t of 3.56 was statistically significant ($p=.003$). The effect size is 2.50.

Socioeconomic Status. Using free or reduced price school lunch as a proxy for socioeconomic status (SES), students' scores could be compared by SES subgroup. The usual correlation between SES and student achievement was found. However, students in all three SES subgroups performed better if they were in I CAN Learn[®] classes. The interaction between lunch status and class type was not statistically significant ($F=.264$; $p=.768$).

Table 8
GCRCT Math Total Means by SES and Class Type

Class Type	Lunch Status	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Traditional	Free	306.803	3.999	298.927	314.679
	Reduced	317.905	6.816	304.481	331.328
	Student paid	330.259	3.470	323.424	337.094
I CAN Learn	Free	315.667	5.702	304.436	326.898
	Reduced	324.714	11.805	301.464	347.965
	Student paid	344.611	4.250	336.240	352.982

Conclusions

Given the findings based on this sample of 254 8th grade students at Gilmer Middle School. It must be concluded that the intervention, I CAN Learn[®], significantly improves student achievement in math as measured by the Georgia CRCT. Further, the effects are beneficial in 6 of 7 math subscales, with both ethnic groups tested, with both males and females, and regardless of students' socioeconomic status. Further research is needed to support these findings with additional schools and school districts and to determine the effects on additional ethnic subgroups, particularly African American students.

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