

Subject: Numbers Bee – Effect of usage on standardized mathematics test scores

Summary:

- ✓ For every 100 minutes of Numbers Bee play, math test scores (DCAS, Delaware Comprehensive Assessment System) increased by 12.8 points.
(Over the course of a year, a student’s DCAS test score improves by about 25 points. Thus, the 12.8-point improvement for 100 minutes of play, represents more than a 40% improvement over and above the annual growth).
- ✓ Numbers Bee users scored, on average, 10 points higher than their non-user counterparts.
- ✓ Students starting at lower scale test scores tended to see greater improvement in their score than students with high starting test scores.

No. of students in the analysis (sample size):

Total number of students – 3,215
Numbers of Numbers Bee users - 1,213

Grades: 3, 4, 5

Location: An urban school district in the state of Delaware, USA

1. Demographic Comparison

- a. The average Numbers Bee user was in 4th grade, basically the same as the average non-user.
- b. Numbers Bee users were ethnically very similar to non-users as well, though slightly more likely to be of Hispanic and Asian background and slightly less likely to be African American.
- c. Numbers Bee users were no more or less likely to be from low income backgrounds.
- d. Numbers Bee users were much more likely to be Regular Education students. Only 10.5% were in Special Education compared to 17.8% of non-users in the 14 elementary schools included in this analysis.
- e. Numbers Bee users were slightly more likely to be English Language Learners (ELL), though still only 8.8% were ELLs.

2. Performance Comparison

- a. Numbers Bee users were much higher performing students to begin with than their non-user peers. On average, on the DCAS Math assessment, they scored 36 instructional scale points higher in Spring 2012 (the pre-assessment for this analysis) and 34 scale points higher in Spring 2013 (post-assessment).
- b. However, growth across the period was comparable between the two groups (average of 31.7 points gained). It is important to note that, on average, we see students starting at lower scale scores tend to grow more in a given period than students with high starting scores. This may be specific to the DCAS test, its scaling, and test item pool differences at the higher end of student performance.

3. Growth (Regression) – Analysis 1

Once we statistically control for grade level, starting scale score (Spring 2012), and other background factors (see table below), Numbers Bee users scored higher on the Spring 2013 DCAS Math assessment. This was a statistically significant finding. After adjusting for all these other factors, and most importantly, Spring 2012 DCAS Math scale score, **Numbers Bee users scored, on average, 10 scale points higher than their non-user counterparts.** This is an interesting finding, but is correlation-based – that is, we cannot say that Numbers Bee usage caused the increased post-assessment finding.

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	241.598	6.226		38.807	.000
	Grade_NUM	-3.704	1.050	-.039	-3.529	.000
	Numbers_Bee_TAG	10.629	1.616	.067	6.576	.000
	MATH_Instr_Scale_Score_High_SPR2012	.713	.010	.829	74.162	.000
2	(Constant)	300.741	7.404		40.621	.000
	Grade_NUM	.577	1.055	.006	.547	.584
	Numbers_Bee_TAG	10.421	1.575	.066	6.615	.000
	MATH_Instr_Scale_Score_High_SPR2012	.633	.011	.735	57.683	.000
	African American	-8.207	1.652	-.052	-4.968	.000
	SpecEd	-23.499	2.278	-.108	-10.315	.000
	Low_Income	-15.942	1.757	-.095	-9.072	.000
	Gender_NUM	-4.386	1.508	-.028	-2.908	.004
ELL_recode	-.475	3.228	-.002	-.147	.883	

a. Dependent Variable: INSTR_SCALE_MATH_SPRING2013_HIGH Highest Spring Math Instructional Scale Score (on either test 1 or 2)

4. Growth by Usage – Analysis 2

Lastly, I looked at Numbers Bee users only. That table is below. For users, I looked at Spring 2013 performance controlling for prior Spring DCAS performance, grade level, and the same student background factors. The key factor here is number of minutes playing the program. You'll see that the number of minutes played does appear to be positively related to post-assessment performance. For every 100 minutes playing the numbers Bee program, students appear to get an average 12.8 scale-point boost to Spring 2013 achievement.

Coefficients^a

tModel		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	239.647	10.194		23.508	.000
	Grade_NUM	-4.464	1.806	-.042	-2.472	.014
	MATH_Instr_Scale_Score_High_SPR2012	.729	.015	.840	47.893	.000
	MinutesPlayed Minutes Played	.135	.030	.072	4.488	.000
2	(Constant)	292.670	12.062		24.264	.000
	Grade_NUM	-.261	1.840	-.002	-.142	.887
	MATH_Instr_Scale_Score_High_SPR2012	.658	.017	.758	37.928	.000
	MinutesPlayed	.128	.029	.068	4.359	.000
	Black	-11.672	2.816	-.067	-4.145	.000
	SpecEd	-18.766	4.486	-.067	-4.184	.000
	Low_Income	-14.771	2.980	-.082	-4.956	.000
	Gender_NUM	-3.752	2.537	-.022	-1.479	.139
	ELL_recode	-8.365	4.868	-.028	-1.718	.086

a. Dependent Variable: INSTR_SCALE_MATH_SPRING2013_HIGH Highest Spring Math Instructional Scale Score (on either test 1 or 2)