Dr Heffernan read that Steenbergen-Hu & Cooper (2013) research suggests that many "smarter" EdTech products for K–12 might actually **exacerbate** the gaps between the lower achieving youth and the general population. So Dr Heffernan and Kim Kelly wanted to check to see if ASSISTments "closed gaps", so we looked to see if the low knowledge students learned more or less than average. The hedge's corrected effect size reported in the paper was .56. We wanted to see if lower knowledge students had a higher effect size showing they were helped more. We luckily had archived out data for the paper at http://www.webcitation.org/6E03PhjrP

To determine low versue high we used the pretest scores. We wanted to do a median split but 46 students had a pretest of zero so we used zero versue above zero for the split. So 46 of 63 had scores of zero and were labeled "low" while the other 17 had scores greater than zero and were label "high".

Here are some means for the whole sample.

Post - Pre * Condition

Post - Pre

Condition	Mean	N	Std. Deviation
Control	.58	33	.252
Experiemental	.74	30	.288
Total	.66	63	.279

Post - Pre * Knowledge Level

Post - Pre

Knowledge Level	Mean	N	Std. Deviation
High	.47	17	.223
Low	.73	46	.268
Total	.66	63	.279

First we did an analysis and kept them together and looked to see if we had an interaction.

Variable 2 is condition
Variable 3 is high/low prior knowledge

Univariate Analysis of Variance

[DataSet0]

Between-Subjects Factors

		N
Condition	Control	33
	Experiemental	30
Knowledge Level	High	17
	Low	46

Tests of Between-Subjects Effects

Dependent Variable:Post - Pre

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1.418[a]	3	.473	8.159	.000
Intercept	17.835	1	17.835	307.971	.000
VAR00002 * VAR00003	.222	1	.222	3.828	.055
VAR00002	.112	1	.112	1.926	.170
VAR00003	.847	1	.847	14.626	.000
Error	3.417	59	.058		
Total	32.040	63			
Corrected Total	4.834	62			

a. R Squared = .293 (Adjusted R Squared = .257)

We interpret this above table to show not a reliable gain once you throw in high versue low knowledge kids but an interaction that is starting to appear (p=.055)

So we split the same data into two parts.

For the high kids we found:

Univariate Analysis of Variance

[DataSet0]

Between-Subjects Factors

		N
Condition	Control	9
	Experiemental	8

Tests of Between-Subjects Effects

Dependent Variable:Post - Pre

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.006[a]	1	.006	.122	.732
Intercept	3.733	1	3.733	70.988	.000
VAR00002	.006	1	.006	.122	.732
Error	.789	15	.053		
Total	4.560	17			
Corrected Total	.795	16			

a. R Squared = .008 (Adjusted R Squared = -.058)

The table above shows that for the 17 “high” kids there is no reliable effect of condition.

Univariate Analysis of Variance

[DataSet0]

Between-Subjects Factors

		N
Condition	Control	24
	Experiemental	22

Tests of Between-Subjects Effects

Dependent Variable:Post - Pre

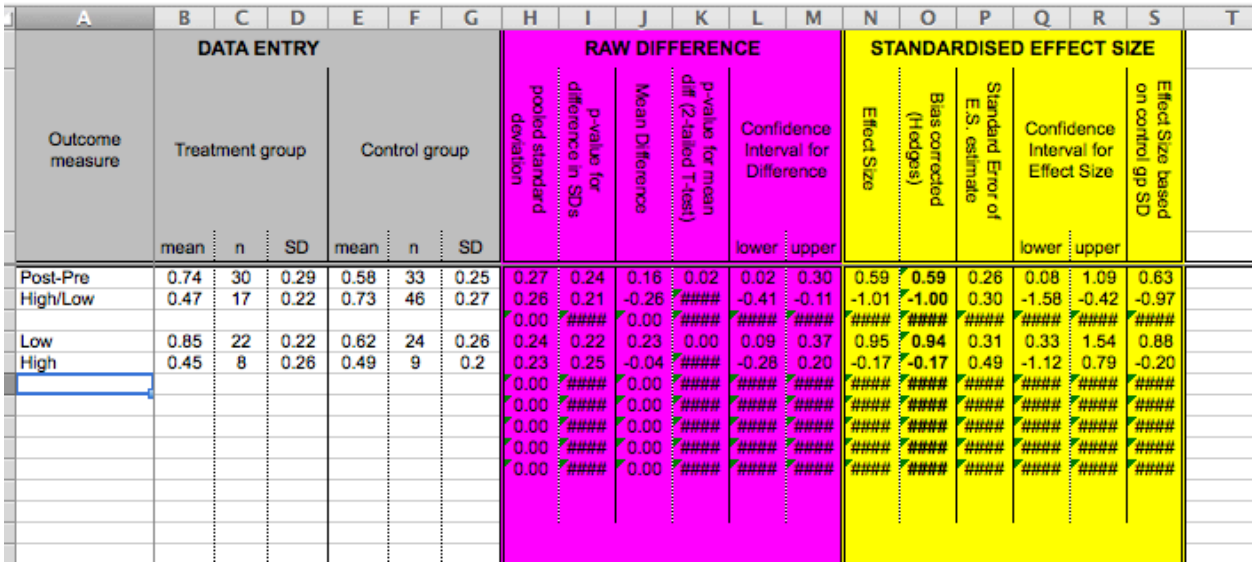
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.601[a]	1	.601	10.060	.003
Intercept	24.538	1	24.538	410.857	.000
VAR00002	.601	1	.601	10.060	.003
Error	2.628	44	.060		
Total	27.480	46			
Corrected Total	3.229	45			

a. R Squared = .186 (Adjusted R Squared = .168)

The table above shows that for the 46 low students there is reliable difference between condition.

To compute the hedge corrected effect sizes we used the same sheet we had archived as well.

http://www.webcitation.org/6E03PhjrP



Outcome measure	DATA ENTRY: Treatment group mean	Treatment group n	Treatment group SD	Control group mean	Control group n	Control group SD	RAW DIFFERENCE: pooled standard deviation	p-value for difference in SDs	Mean Difference	p-value for mean diff (2-tailed T-test)	Confidence Interval for Difference lower	Confidence Interval for Difference upper	STANDARDISED EFFECT SIZE: Effect Size	Bias corrected (Hodges)	Standard Error of E.S. estimate	Confidence Interval for Effect Size lower	Confidence Interval for Effect Size upper	Effect Size based on control gp SD
Post-Pre	0.74	30	0.29	0.58	33	0.25	0.27	0.24	0.16	0.02	0.02	0.30	0.59	**0.59**	0.26	0.08	1.09	0.63
High/Low	0.47	17	0.22	0.73	46	0.27	0.26	0.21	-0.26	####	-0.41	-0.11	-1.01	**-1.00**	0.30	-1.58	-0.42	-0.97
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####
Low	0.85	22	0.22	0.62	24	0.26	0.24	0.22	0.23	0.00	0.09	0.37	0.95	**0.94**	0.31	0.33	1.54	0.88
High	0.45	8	0.26	0.49	9	0.2	0.23	0.25	-0.04	####	-0.28	0.20	-0.17	**-0.17**	0.49	-1.12	0.79	-0.20
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####
							0.00	####	0.00	####	####	####	####	**#####**	####	####	####	####

CMS spreadsheet to computer the Hedged Corrected effect sizes and 95% confidence intervals

It shows that effect size for the low kids is .94.

We concluded that ASSIStments closed gaps be helping the low students.

References

Steenbergen-Hu, S., & Cooper, H. (2013). A meta-analysis of the effectiveness of intelligent tutoring systems on K–12 students' mathematical learning. *Journal of Educational Psychology, 105*(4), 970-987. doi:10.1037/a0032447

Steenbergen-Hu, S., & Cooper, H. (2014). A meta-analysis of the effectiveness of intelligent tutoring systems on college students' academic learning. *Journal of Educational Psychology, 106*(2), 331-347. doi:10.1037/a0034752