NJ—Statistical analysis of EiE data for Stevens Institute of Technology

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The Samples

In this analysis, I compare Fall River, MA (our only control sample) against the Stevens sample from NJ. There are some issues with this—there are demographic differences, and also I have found differences between state results which I have not yet explained[1]. However, it does not seem unreasonable to make this comparison, since the two samples are fairly similar in many ways.

Sample Size

We are working with a sample size of 345 students from NJ and 1073 students from MA. Each NJ student did a complete General Engineering assessment, as well as all questions from the Water Filters and Windmills units. Each MA student did 1/3 of the General Engineering assessment (questions randomly assigned), and only some students answered Water Filters questions. The Windmills questions were assigned to grade 2 students for the control sample, and were not used to compare against the grade 4 and 5 students from NJ.

Grade

I chose to run the comparison using only grades 4 and 5. We have no grade 2 data from NJ, and only 41 grade 3 students, while the Fall River population had a majority of grade 3 students. By limiting the comparison to grades 4 and 5, the distribution across grades became proportionally more similar, though still statistically significant (Nominal by Interval Eta p=.144).

Crosstab

			Grade		
			Grade 4	Grade 5	Total
Population	MA Control	Count	515	558	1073
		% within Population	48.0%	52.0%	100.0%
	NJ	Count	150	195	345
		% within Population	43.5%	56.5%	100.0%
Total		Count	665	753	1418
		% within Population	46.9%	53.1%	100.0%

Gender

Gender differences were insignificant, with both populations being split roughly 50-50%.

Free and Reduced Lunch

The Fall River sample has a significantly higher proportion of students receiving free or reduced lunch (Goodman & Kruskal Tau-b p=.000). 67.5% of the Fall River sample receives free or reduced lunch, while only 18.0% of the NJ sample does.

Primary Language

[1] These differences could be due to demographic differences, state culture and workforce differences, differences between the effectiveness of the workshops run by different states, some combination of these factors, or something else entirely. I am continuing to investigate them and will update this report in the future.

26.4% of the Fall River students had as their primary language a language other than English. 15.4% of NJ students had a primary language other than English. This difference is significant (Goodman & Kruskal Tau-b p=.000).

Race/Ethnicity
Significant differences in racial makeup between the Fall River, MA and the NJ samples exist (Goodman & Kruskal Tau-b p=.000). Fall River has proportionally more white students (79.6% versus 63.6%) and black students (8.6% versus 6.5%). NJ has larger proportions of Asian (12.6% versus 4.5%) and Hispanic (13.2% versus 6.6%) students.

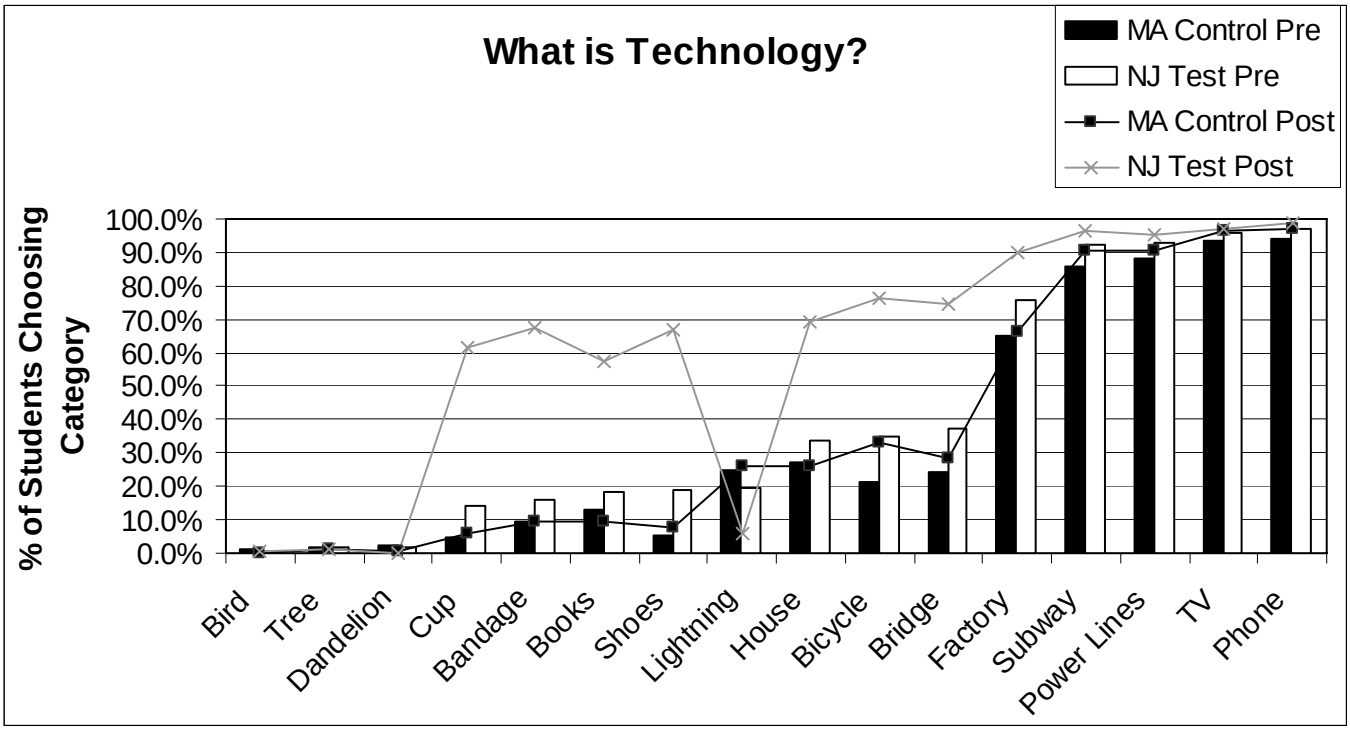
Crosstab

		Population				Total	
		MA Control		NJ			
		Count	% within Population	Count	% within Population	Count	% within Population
Race/ Ethnicity	Black/African/ African American	92	8.6%	22	6.5%	114	8.1%
	Indian Asian	0	.0%	17	5.0%	17	1.2%
	Central/ Southeast/East Asian	48	4.5%	26	7.6%	74	5.3%
	Multiracial	0	.0%	1	.3%	1	.1%
	White/ Caucasian	849	79.6%	217	63.6%	1066	75.7%
	White Hispanic/ Latino(a)	70	6.6%	45	13.2%	115	8.2%
	Native American	7	.7%	9	2.6%	16	1.1%
	Pacific Islander	1	.1%	4	1.2%	5	.4%
Total		1067	100.0%	341	100.0%	1408	100.0%

Pre-Post Differences on General Engineering Questions
Students were tested twice—once before the Engineering is Elementary unit was begun, and once after it was completed—allowing for a test-retest analysis. Student responses were scored as "correct" or "incorrect" before beginning analysis. Since all results were therefore binomial, significant changes from the pre-assessment to the post-assessment were analyzed using McNemar's Test of Symmetry, a crosstabulation analysis designed for binomial nominal data. Differences between the test subjects (NJ students) and the control subjects (Fall River, MA students) were analyzed using Goodman and Kruskal's tau-b. This chi-square variant is designed for analyzing nominal by nominal data for a crosstab table that is larger than 2x2.

What is Technology?
It's easiest to see the differences looking at the graph below. You'll notice two things right away. First, NJ EiE students did better than the MA control students on the pre-assessment. I am attributing this to the

much larger proportion of MA students who are getting free or reduced lunch, because I have found that this makes a fairly large difference in scores. Second, you will see that the MA post-assessment line (the black line with squares) closely hugs the pre-assessment bars—but the NJ post-assessment line (the gray line) is very different, showing that on the post-assessment the NJ students consistently separated natural things from human-made things in choosing which things are technology. 320 MA Control students and 194 NJ students completed this question.



Below is the table from which this graph is drawn.

What is Technology?		Pre	Post
Bird	MA Control	0.9%	0.3%
	NJ Test	0.6%	0.7%
Dandelion	MA Control	2.2%	0.8%
	NJ Test	1.7%	0.0%
Tree	MA Control	2.0%	1.1%
	NJ Test	2.0%	1.3%
Cup	MA Control	4.9%	6.1%
	NJ Test	14.0%	61.5%
Bandage	MA Control	9.7%	9.2%
	NJ Test	16.0%	67.4%
Books	MA Control	12.8%	9.2%
	NJ Test	18.4%	57.1%
Shoes	MA Control	5.4%	7.5%
	NJ Test	18.7%	66.8%
Lightning	MA Control	24.9%	26.2%
	NJ Test	19.5%	6.0%
House	MA Control	27.3%	26.1%
	NJ Test	33.5%	69.4%

Bicycle	MA Control	21.1%	33.0%
	NJ Test	34.7%	76.4%
Bridge	MA Control	24.0%	28.6%
	NJ Test	37.0%	74.8%
Factory	MA Control	64.9%	66.4%
	NJ Test	75.8%	89.7%
Subway	MA Control	85.8%	90.8%
	NJ Test	92.4%	96.7%
Power Lines	MA Control	88.1%	90.5%
	NJ Test	92.7%	95.3%
TV	MA Control	93.3%	96.7%
	NJ Test	95.9%	97.0%
Phone	MA Control	94.2%	97.2%
	NJ Test	97.1%	99.0%

The following table displays significant pre- to post- differences within each population, as well as significant differences between the two populations. “Neither correct” is the percentage of students who answered incorrectly on both the pre- and the post-assessments; “both correct” is the percentage of students who answered correctly both times; “regressed” is the percentage of students who answered correctly on the pre- but incorrectly on the post-; and “improved” is the percentage of students who answered incorrectly on the pre- but correctly on the post-assessment. I have marked the significant differences in yellow.

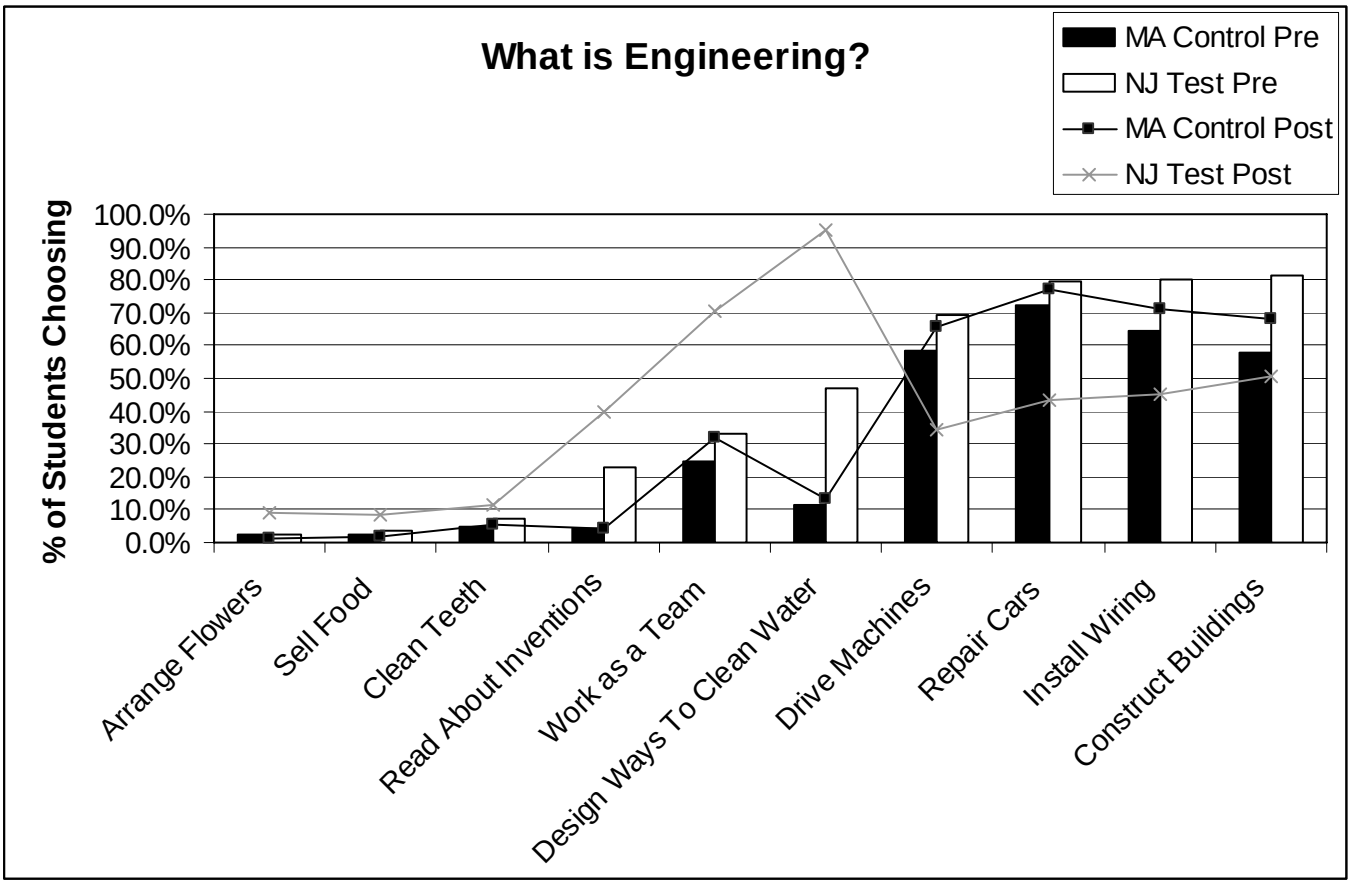
The easiest items—Bird, Dandelion, Tree, Television, Power Lines, and Phone—all have either no significant differences or relatively low significant differences between Test & Control and between Pre & Post. The more difficult items—which are clustered in the center of the each chart—all show significant differences from Pre to Post for the NJ students, and significant differences between the MA Control and NJ EiE students. If you look at the “Improved” column of this chart, you will see that the significant differences are large ones: generally only about 5-25% of the MA control students improved their scores, while 40-50% of the NJ EiE students did (Factory, Subway, Power Lines, and Phone are the exceptions).

What is Technology?		Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
Bird	MA Control	0.0%	99.4%	0.3%	0.3%	1.000
	NJ	0.0%	98.6%	0.7%	0.7%	1.000
	Goodman Kruskal tau p=	0.527				
Dandelion	MA Control	0.3%	97.5%	0.6%	1.6%	0.453
	NJ	0.0%	98.3%	0.0%	1.7%	
	Goodman Kruskal tau p=	0.738				
Tree	MA Control	0.0%	97.8%	0.9%	1.3%	1.000
	NJ	0.0%	96.6%	1.4%	2.0%	0.754
	Goodman Kruskal tau p=	0.531				
Cup	MA Control	90.9%	0.9%	3.1%	5.0%	0.327
	NJ	36.9%	14.0%	1.4%	47.8%	0.000
	Goodman Kruskal tau p=	0.000				
Bandage	MA Control	84.4%	2.2%	6.3%	7.2%	0.761
	NJ	31.3%	16.0%	1.4%	51.4%	0.000

	Goodman Kruskal tau p=	0.000				
Books	MA Control	82.6%	1.6%	8.8%	6.9%	0.480
	NJ	39.6%	16.4%	3.4%	40.6%	0.000
	Goodman Kruskal tau p=	0.000				
Shoes	MA Control	90.0%	1.3%	3.1%	5.6%	0.185
	NJ	30.6%	18.0%	2.4%	49.0%	0.000
	Goodman Kruskal tau p=	0.000				
Lightning	MA Control	11.6%	60.8%	13.8%	13.8%	1.000
	NJ	3.4%	79.3%	2.7%	14.6%	0.000
	Goodman Kruskal tau p=	0.000				
House	MA Control	57.8%	10.0%	16.6%	15.6%	0.844
	NJ	26.2%	30.6%	3.7%	39.5%	0.000
	Goodman Kruskal tau p=	0.000				
Bicycle	MA Control	55.5%	8.5%	10.7%	25.4%	0.000
	NJ	21.8%	34.0%	2.0%	42.2%	0.000
	Goodman Kruskal tau p=	0.000				
Bridge	MA Control	58.1%	9.1%	13.8%	19.1%	0.118
	NJ	21.8%	34.4%	4.1%	39.8%	0.000
	Goodman Kruskal tau p=	0.000				
Factory	MA Control	17.5%	47.2%	15.0%	20.3%	0.132
	NJ	5.8%	73.5%	4.8%	16.0%	0.000
	Goodman Kruskal tau p=	0.000				
Subway	MA Control	3.4%	82.1%	3.8%	10.7%	0.002
	NJ	1.4%	90.1%	2.0%	6.5%	0.015
	Goodman Kruskal tau p=	0.001				
Power Lines	MA Control	1.6%	81.2%	7.2%	10.0%	0.281
	NJ	1.4%	88.7%	3.4%	6.5%	0.136
	Goodman Kruskal tau p=	0.003				
Television	MA Control	0.0%	91.3%	3.4%	5.3%	0.345
	NJ	0.3%	92.9%	2.7%	4.1%	0.503
	Goodman Kruskal tau p=	0.695				
Phone	MA Control	0.9%	92.5%	1.6%	5.0%	0.027
	NJ	0.0%	96.6%	1.0%	2.4%	0.344
	Goodman Kruskal tau p=	0.013				

What is Engineering?

The differences Pre- to Post- for NJ EiE students are not as dramatic with the *What is Engineering?* items as for the *What is Technology?* items, but are still clear. Once again, you can see in the graph that NJ students outperformed MA control students on the post-assessments: while the black MA Control post-assessment line closely hugs the black pre-assessment bars, the gray NJ post-assessment line shows that considerably more NJ students think that engineers read about inventions, work as a team, and design ways to clean water after completing EiE units than beforehand. In addition, NJ students are much less likely to think that engineers drive machines, repair cars, install wiring, or construct buildings after completing EiE units. Unfortunately they are also slightly more likely to think that engineers "do everything"—they are more likely to say that engineers arrange flowers, sell food, and clean teeth for their jobs as well. All of these patterns mirror patterns we see in the larger, national sample of EiE students.



What kinds of work do engineers do for their jobs?		Pre	Post
Arrange Flowers	MA Control	2.3%	1.1%
	NJ Test	2.3%	9.0%
Sell Food	MA Control	2.7%	2.0%
	NJ Test	3.8%	8.6%
Clean Teeth	MA Control	4.9%	5.2%
	NJ Test	7.3%	11.6%
Read About Inventions	MA Control	4.2%	4.3%
	NJ Test	23.1%	39.9%
Work as a Team	MA Control	25.0%	31.7%
	NJ Test	33.0%	70.4%
Design Ways To Clean Water	MA Control	11.2%	13.2%
	NJ Test	47.1%	95.3%
Drive Machines	MA Control	58.7%	65.5%
	NJ Test	69.2%	34.2%
Repair Cars	MA Control	72.5%	76.9%
	NJ Test	79.5%	43.5%
Install Wiring	MA Control	64.6%	71.1%
	NJ Test	80.1%	45.2%
Construct Buildings	MA Control	57.8%	66.2%
	NJ Test	81.2%	50.5%

The chart below shows significant differences. Significant improvements from pre- to post are shown in yellow in the column "McNemar Test of Symmetry". Significant regressions (that is, where students were significantly less likely to choose the correct answer) are marked in blue in that column.

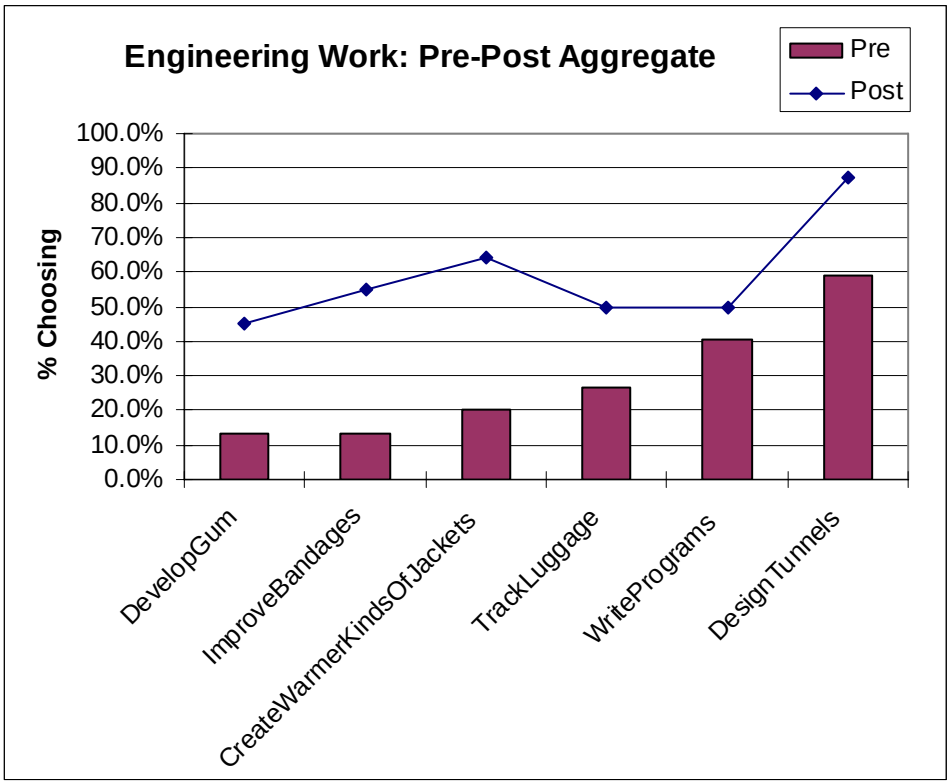
Significant differences exist between the NJ student response patterns and those of the MA control students on every question. For the three jobs least likely to be chosen by students as the kind of work that engineers do—Arrange Flowers, Sell Food, and Clean Teeth, NJ EiE students showed a slight but significant tendency to regress on the post-assessment (that is, to choose these as "engineering" jobs on the post-assessment when they had not chosen them on the pre-). MA control students showed no significant change on these three items. For Read About Inventions and Design Ways to Clean Water, MA control students showed no significant change from pre- to post-, but NJ students were much more likely to choose these jobs as engineering (p=.000). NJ students were also much more likely to say that engineers Work as a Team on the post-assessment (p=.000), but MA students were also more likely to choose that item (p=.032). For the final four items—Drive Machines, Repair Cars, Install Wiring, and Construct Buildings—NJ students were significantly more likely on the post-assessment to get them correct (by not choosing them as engineering work—p=.000) while MA control students were significantly **less** likely to answer them correctly.

What is Engineering?		Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
Arrange Flowers	MA Control	0.0%	96.9%	1.0%	2.1%	0.388
	NJ	0.0%	88.1%	9.2%	2.7%	0.002
	Goodman Kruskal tau p=	0.000				
Sell Food	MA Control	0.0%	96.1%	1.3%	2.6%	0.302
	NJ	1.0%	88.7%	7.8%	2.4%	0.005
	Goodman Kruskal tau p=	0.000				
Clean Teeth	MA Control	1.0%	91.5%	4.1%	3.3%	0.711
	NJ	1.7%	83.3%	10.2%	4.8%	0.023
	Goodman Kruskal tau p=	0.000				
Read About Inventions	MA Control	93.0%	0.5%	2.8%	3.6%	0.690
	NJ	49.8%	13.3%	10.2%	26.6%	0.000
	Goodman Kruskal tau p=	0.000				
Work As A Team	MA Control	56.3%	13.7%	11.9%	18.1%	0.032
	NJ	25.9%	30.0%	3.8%	40.3%	0.000
	Goodman Kruskal tau p=	0.000				
Design Ways To Clean Water	MA Control	78.6%	3.4%	8.2%	9.8%	0.550
	NJ	3.8%	46.4%	1.0%	48.8%	0.000
	Goodman Kruskal tau p=	0.000				
Drive Machines	MA Control	44.8%	21.1%	21.4%	12.6%	0.004
	NJ	25.7%	23.6%	8.6%	42.1%	0.000
	Goodman Kruskal tau p=	0.000				
Repair Cars	MA Control	62.2%	12.3%	15.4%	10.0%	0.044
	NJ	36.2%	13.3%	7.8%	42.7%	0.000
	Goodman Kruskal tau p=	0.000				
Install Wiring	MA Control	51.4%	15.7%	20.6%	12.3%	0.006
	NJ	37.9%	12.6%	7.8%	41.6%	0.000
	Goodman Kruskal tau p=	0.000				

Construct Buildings	MA Control	45.0%	22.4%	21.1%	11.6%	0.001
	NJ	45.2%	12.3%	5.5%	37.0%	0.000
	Goodman Kruskal tau p=	0.000				

Some questions in the *What is Engineering?* table were new to the assessments since control data was collected, so there is no control comparison. These questions are discussed in the following chart and table.

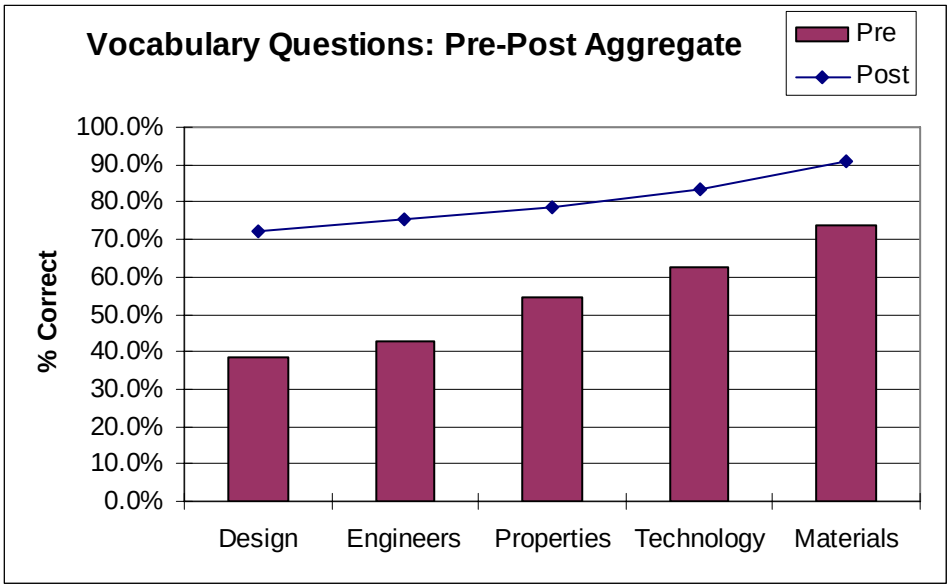
New Jersey students were significantly more likely on the post-assessment than on the pre-assessment to say that engineers might improve bandages, develop gum, track luggage, create warmer kinds of jackets, design tunnels, and write computer programs for their jobs. All differences but one (write computer programs) were highly significant according to the McNemar Test of Symmetry (see the table and chart below).



What is Engineering?	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
Develop Better Bubble Gum	51.9%	10.6%	2.4%	35.2%	0.000
Write Computer Programs	32.8%	25.6%	17.7%	23.9%	0.123
Figure Out How to Track Luggage	41.6%	18.8%	8.2%	31.4%	0.000
Improve Bandages	41.3%	11.3%	2.7%	44.7%	0.000
Create Warmer Kinds of Jackets	32.4%	16.7%	3.4%	47.4%	0.000
Design Tunnels	7.5%	55.3%	5.5%	31.7%	0.000

Vocabulary Questions

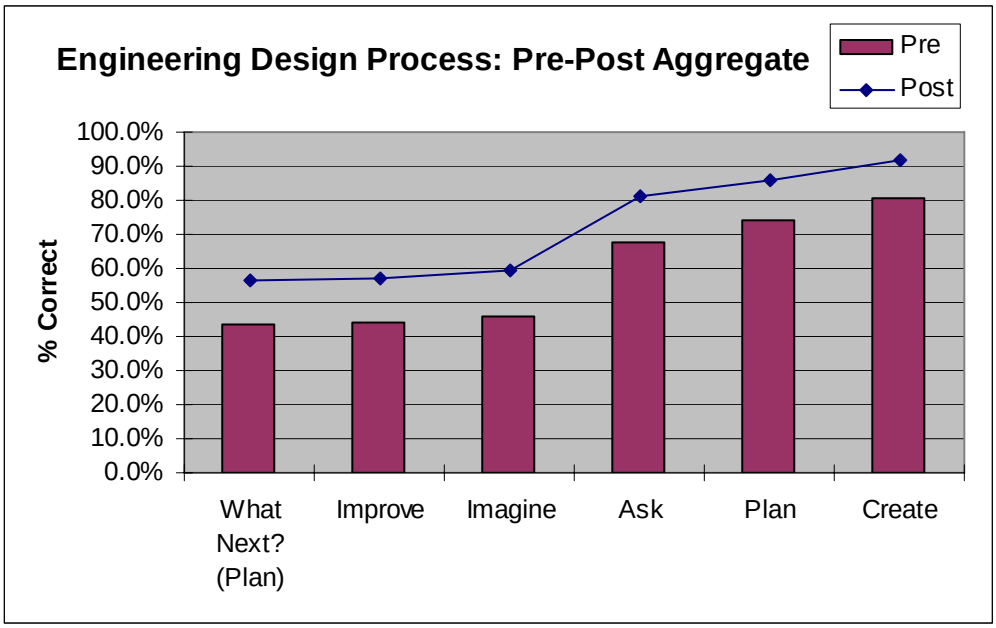
Students were asked to correctly complete sentences with engineering vocabulary words. For each sentence, they were given three words to choose from. NJ students participating in EiE were significantly more likely (p=.000) to choose the correct vocabulary word on the post-assessment than on the pre-assessment. 278 NJ students answered these questions. (Again, MA control students did not receive these questions so there is no comparison available.)



Vocabulary Questions	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
Properties	15.6%	49.5%	5.5%	29.5%	0.000
Materials	4.3%	71.9%	4.3%	19.4%	0.000
Technology	8.3%	55.4%	8.7%	27.5%	0.000
Design	19.8%	31.3%	8.6%	40.3%	0.000
Engineers	17.3%	35.0%	6.9%	40.8%	0.000

Questions about the Engineering Design Process

We asked the NJ students a series of questions about the engineering design process. Each question presented a scenario where children were designing something, and asked which step of the engineering design process those children were engaged in. In one case, the question asked which step would come next. On all questions, NJ EiE students were significantly more likely to choose the correct answers on the post-assessment than on the pre-assessment.



Engineering Design Process Questions	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
What Next? (Plan)	23.2%	26.4%	20.1%	30.3%	0.019
Improve	29.3%	31.7%	13.4%	25.5%	0.001
Imagine	22.7%	31.5%	16.8%	29.0%	0.003
Ask	9.9%	60.2%	8.5%	21.5%	0.000
Plan	6.0%	68.7%	8.1%	17.3%	0.003
Create	3.1%	78.0%	4.5%	14.4%	0.000

A Question Asking about Materials
One more question was asked of students:

"Maria and Bobby designed a chair that they wanted to make. Bobby suggested making it out of wood. Maria wanted to use plastic or metal. What are Maria and Bobby talking about?"

83.5% of NJ EiE students correctly identified the answer as "Material for the chair" on the pre-assessment. 90.5% correctly identified the answer on the post-assessment. This difference is significant (McNemar Test of Symmetry p=.036). However, because so many students answered it correctly on the pre-assessment, this question has been dropped from the new 2006-2007 assessments.

Results for the Designing Water Filters Unit Questions

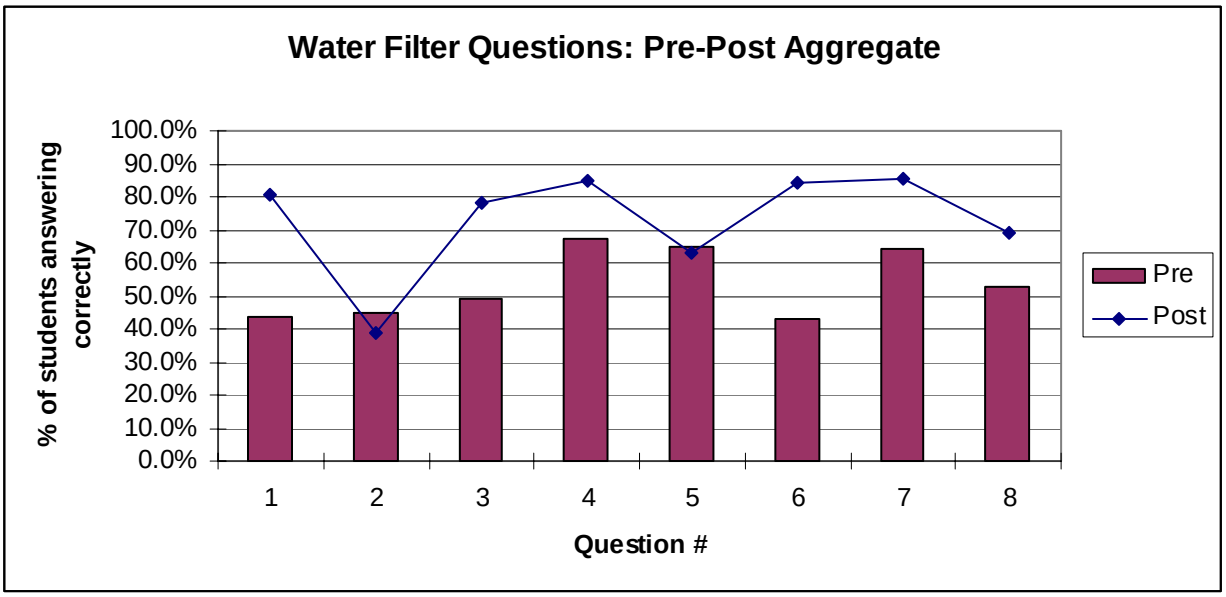
Designing Water Filters Unit Question with Control Comparison
Only one question on the Water Filters unit assessment was shared between the control sample and the NJ test (EiE) sample. This question asked about condensation. NJ EiE students were significantly more likely to answer this question correctly on the post-assessment than on the pre-assessment; while the pre-post

difference for MA control students was not significant. However, NJ students were significantly less likely to answer this question correctly than MA students on the pre-assessment and also on the post-assessment, for unknown reasons.

		Neither correct	Both correct	Regressed	Improved	n=	McNemar Test of Symmetry p=
Condensation Question	MA Control	3.8%	75.6%	9.4%	11.3%	160	0.728
	NJ	22.3%	43.5%	6.7%	27.6%	283	0.000
	Goodman Kruskal tau p=	0.000					

Designing Water Filters Unit Questions without Control Comparison

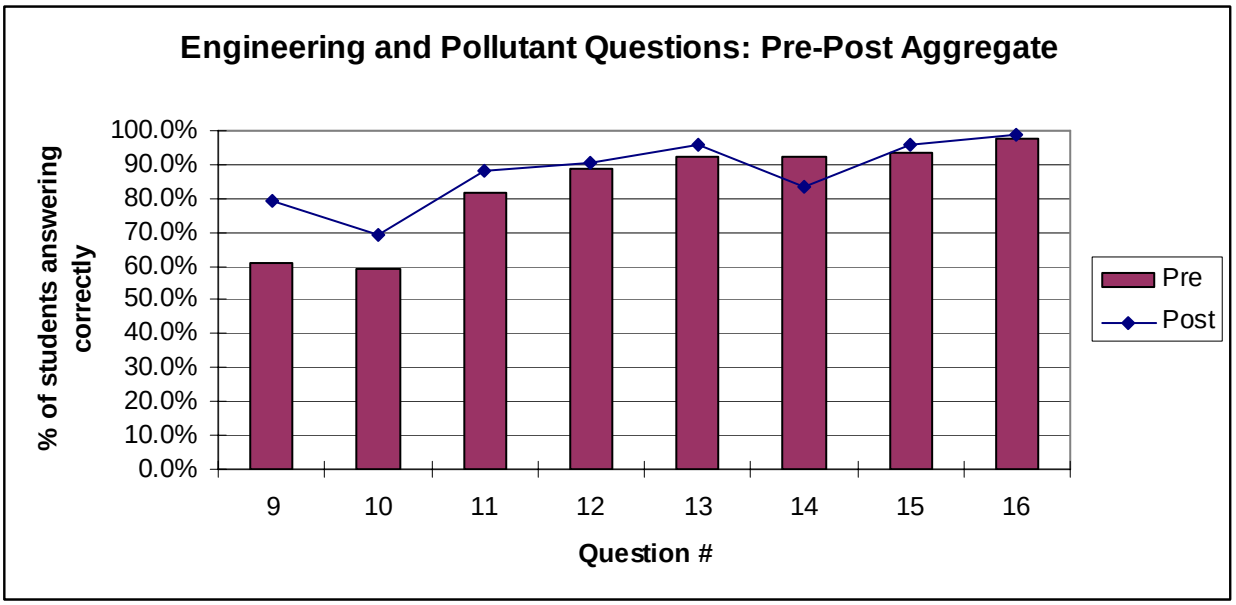
NJ students were asked eight questions about water filters and water filter materials. On all of these but two, students were significantly more likely to answer correctly on the post-assessment than on the pre-assessment. The two questions asking about sand as a filter material did not show significant pre-post changes when looked at in aggregate, which may reflect students' mixed results using this material in the classroom. Results for questions asking about other filter materials—paper and screen—were dramatically improved, as was the question asking about methods for cleaning water (students were much more likely on the post-assessment to correctly mark the distractor, "use soap", as NOT a way to clean water).



Question #	Test-Only Questions	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
1	What is NOT a way to make water cleaner?	16.1%	38.2%	4.2%	41.4%	0.000
2	Would SAND be a good material to filter leaves from water?	35.3%	19.6%	24.5%	20.6%	0.379
3	Would PAPER be a good material to filter leaves from water?	16.0%	40.4%	7.0%	36.6%	0.000
4	Would a SCREEN be a good material to filter leaves from water?	7.7%	58.7%	9.1%	24.5%	0.000

5	Would SAND be a good material to filter flour from water?	14.0%	42.0%	23.8%	20.3%	0.423
6	Would PAPER be a good material to filter flour from water?	7.3%	32.8%	8.0%	51.9%	0.000
7	Would a SCREEN be a good material to filter flour from water?	5.6%	54.4%	9.1%	31.0%	0.000
8	What material is best to use for a net to clean pool water?	20.0%	40.0%	9.7%	30.3%	0.000

NJ EiE students were also asked questions about the kinds of work done by environmental engineers, and about items that might contribute pollutants to the air. Two of the four questions about engineering work showed significant improvement; the fourth showed a ceiling effect (about 90% correct both pre- and post-). The question about pollutants proved, for the most part, to be much too easy for students in grades 4-5, and has been omitted from future assessments. The only exception was the question about the "dog", which we have decided is problematic, since dogs (like cows, which are sometimes discussed in lesson 2 of the Water Filters unit) do release tiny amounts of methane, which is a pollutant in large quantities.

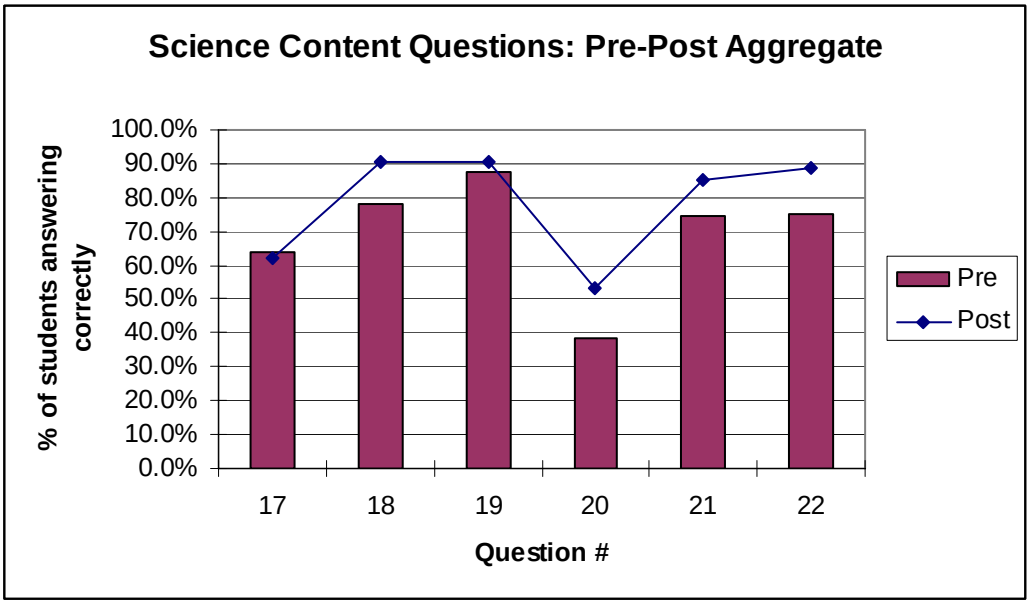


Question #	Test-Only Questions	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
9	For his job, an environmental engineer might stop harmful plants from growing in a lake.	10.7%	51.4%	10.0%	27.9%	0.000
10	For his job, an environmental engineer might rescue dolphins.	20.3%	47.4%	11.3%	21.0%	0.005
11	For his job, an environmental engineer might decide how to clean air.	5.2%	74.1%	7.9%	12.8%	0.092
12	For his job, an environmental engineer might sort river rocks.	2.4%	81.4%	7.6%	8.6%	0.771
13	A CAR could add pollutants to	2.1%	90.7%	2.4%	4.8%	0.189

	the air.					
14	A DOG could add pollutants to the air.	4.8%	79.7%	12.7%	2.7%	0.000
15	A WATERFALL could add pollutants to the air.	1.7%	91.4%	3.1%	3.8%	0.824
16	A FACTORY could add pollutants to the air.	0.3%	96.9%	1.0%	1.7%	0.727

Designing Water Filters Science Content Questions

The remaining six questions for the Water Filters unit are science content questions. NJ EiE students showed significant improvement on all but two of these questions. Of the two, question #19 appears to have been too easy for grades 4-5 (nearly 88% of students answered the pre-assessment correctly) and so is showing a ceiling effect. The other question showed a slight and not significant regression (fewer students answered correctly on the post-assessment): question #17. This is consistent with results we have seen in other populations (Massachusetts and nationally) and may reflect either a common misconception, or a poorly worded question (if you think about the generation of new fresh water over time through the water cycle, then Earth ultimately has unlimited fresh water). The question has been revised for future assessments.

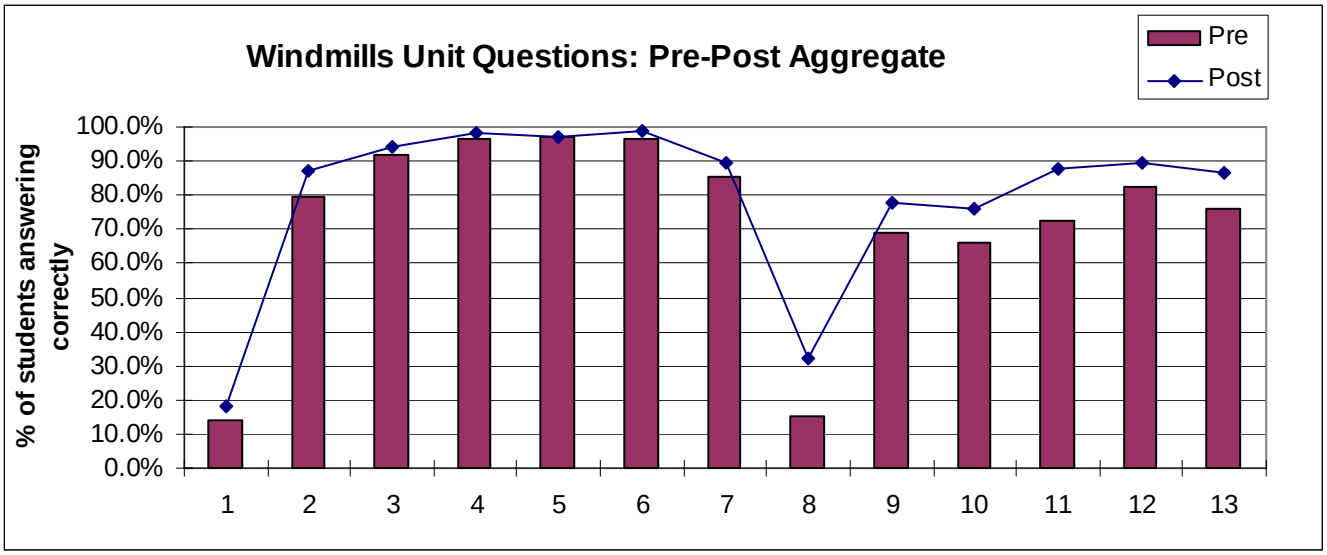


Question #	Test-Only Questions	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
17	True or false: Earth has a limited amount of fresh water	23.0%	50.5%	15.0%	11.5%	0.302
18	True or false: Condensation is part of the water cycle	3.8%	73.4%	5.5%	17.3%	0.000
19	True or false: Water disappears forever when it evaporates	2.4%	82.7%	6.2%	8.7%	0.360
20	True or false: The water cycle makes new water	38.9%	29.2%	9.7%	22.2%	0.000

21	True or false: If polluted water freezes, it is no longer contaminated	7.3%	67.1%	7.6%	18.0%	0.001
22	True or false: Water can be a solid, liquid, or gas	7.3%	70.8%	2.8%	19.1%	0.000

Results for the Designing Windmills Unit Questions

NJ students performed consistently better on the post-assessment than on the pre-assessment, but not all changes pre- to post- were significant. Question 1 appears to have been too difficult for students--only 13% answered correctly on the pre-assessment, and only 18% on the post-assessment. Questions 2 through 6 were too easy for students, with over 90% of students answering the pre-assessment correctly for four out of five items. For the remainder of the items—all of which were "engineering" content questions—NJ students showed significant improvement.



Question #	Windmills Unit Question	Neither correct	Both correct	Regressed	Improved	McNemar Test of Symmetry p=
1	Which does NOT show how hard the wind is blowing?	76.3%	7.2%	6.5%	10.1%	0.184
2	GLIDER uses the energy of the wind	6.3%	73.1%	6.3%	14.3%	0.004
3	WEATHER VANE uses the energy of the wind	2.4%	89.2%	3.1%	5.2%	0.307
4	SAILING SHIP uses the energy of the wind	0.7%	95.1%	1.4%	2.8%	0.388
5	COMPUTER uses the energy of the wind	0.7%	95.1%	2.1%	2.1%	1.000
6	KITE uses the energy of the wind	0.3%	96.2%	1.0%	2.4%	0.344
7	ROCKET uses the energy of the wind	6.0%	81.8%	4.2%	8.1%	0.090

8	Improve windmill: Add more blades	62.0%	9.4%	5.9%	22.6%	0.000
9	Improve windmill: Put holes in the blades	13.9%	59.9%	9.1%	17.1%	0.011
10	Improve windmill: Change the material of blades	15.0%	57.1%	8.7%	19.2%	0.001
11	Improve windmill: Change the angle of blades	9.8%	70.3%	2.4%	17.5%	0.000
12	Windmills and sailboats:	7.9%	78.8%	3.2%	10.1%	0.003
13	For his job, mechanical engineer might:	8.3%	70.9%	5.3%	15.5%	0.000