

## Summary Data by Group and Instructor 2003 to 2007

This study provides preliminary analysis of student academic performance in courses that used clicker technology and those that did not. Clickers were used exclusively by Mr. David Vakil, Professor of Astronomy and Physics, during this period. The clickers were used in Astronomy 20 and 25 (or equivalent) and Physics 2A so data were collected and summarized for all sections of these courses during the study period.

Groups B and D represent the academic performance information for terms in which Mr. Vakil used the clickers (Spring 2006 through the present). Fall-Spring and Summer data were kept separate to control for the sufficiently different demographics of summer vs. fall/spring students. Data from before clicker implementation are included (Groups A and C) to serve as a control or comparison group. Performance in the Vakil/clicker sections is highlighted in yellow.

### Group A - Fall-Spring Pre-Clickers

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
D. Vakil	9	78	14.7	94	17.8	108	20.4	60	11.3	46	8.7	2	141	26.7	529	52.9	73.3	2.28
All Others	50	276	12.3	432	19.3	486	21.7	146	6.5	218	9.8	9	668	29.9	2235	53.4	70.1	2.32
Total/Average	59	354	12.8	526	19.0	594	21.5	206	7.5	264	9.6	11	809	29.3	2764	53.3	70.7	2.31

### Group B - Fall-Spring After Clicker Implementation

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
D. Vakil	11	53	12.6	72	17.1	135	32.1	40	9.5	16	3.8	0	104	24.8	420	61.9	75.2	2.48
All Others	32	263	16.9	298	19.1	311	20.0	110	7.1	117	7.5	7	452	29.0	1558	56.0	71.0	2.50
Total/Average	43	316	16.0	370	18.7	446	22.5	150	7.6	133	6.7	7	556	28.1	1978	57.2	71.9	2.49

### Group C - Summer Pre-Clickers

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
D. Vakil	1	24	27.3	14	15.9	18	20.5	2	2.3	2	2.3	0	28	31.8	88	63.6	68.2	2.93
All Others	11	87	19.4	139	31.0	119	26.5	22	4.9	21	4.7	2	59	13.1	449	76.8	86.9	2.75
Total/Average	12	111	20.7	153	28.5	137	25.5	24	4.5	23	4.3	2	87	16.2	537	74.7	83.8	2.78

## Group D - Summer After Clicker Implementation

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
D. Vakil	2	54	34.6	22	14.1	44	28.2	18	11.5	8	5.1	0	10	6.4	156	76.9	93.6	2.66
All Others	5	73	31.6	72	31.2	46	19.9	5	2.2	15	6.5	0	20	8.7	231	82.7	91.3	2.86
Total/Average	7	127	32.8	94	24.3	90	23.3	23	5.9	23	5.9	0	30	7.8	387	80.4	92.2	2.77

### Preliminary Analysis

As shown in the table below, academic performance data suggest that clicker technology contributes to increased success, retention and overall course performance (GPA) in fall and spring courses. For example, before-and-after clicker performance for Vakil (yellow columns) shows a 9-point increase in success and a 2-point increase in retention compared with 2.5- and 1-point improvements for all others teaching the same courses. The difference in GPA improvement in clicker classes compared with others was smaller and may not be significantly different when tested. However, the pre- and post-course grade distributions were noticeably different—clicker classes produced a greater percentage of Cs along with declines in Ds, Fs and Ws, perhaps converting D/F/W students into C students due to the added classroom engagement that clickers promote.

The comparison of each group across instructors is also revealing. Reading across rows, Vakil had about the same success rate (<1-point difference), a higher retention rate (3-point difference) and about the same GPA in fall-spring courses compared to peers before implementing the clickers. After clickers, success was much higher with relative improvement in retention and GPA.

The difference is even more pronounced in summer terms (with the exception of GPA); however, these results should be used with caution since too few courses taught by Vakil contribute to wider swings in the quoted rates. The strongest evidence indicates that clickers may help with class retention (which sometimes negatively affects GPA).

Group	Sections	Total Enrolled	Success (%)			Retention (%)			GPA		
			Vakil	Others	Diff.	Vakil	Others	Diff.	Vakil	Others	Diff.
Fall-Spring Pre-Clickers (A)	59	2764	52.9	53.4	-0.5	73.3	70.1	3.2	2.28	2.32	-0.04
Fall-Spring With Clickers (B)	43	1978	61.9	56.0	5.9	75.2	71.0	4.2	2.48	2.50	-0.02
<b><i>Difference Before &amp; After Clickers (Fall-Spring)</i></b>			<b>9.0</b>	<b>2.5</b>		<b>1.9</b>	<b>0.9</b>		<b>0.20</b>	<b>0.18</b>	
Summer Pre-Clickers (C)	12	537	63.6	76.8	-13.2	68.2	86.9	-18.7	2.93	2.75	0.18
Summer With Clickers (D)	7	387	76.9	82.7	-5.8	93.6	91.3	2.2	2.66	2.86	-0.20
<b><i>Difference Before &amp; After Clickers (Summer)</i></b>			<b>13.3</b>	<b>5.8</b>		<b>25.4</b>	<b>4.5</b>		<b>-0.28</b>	<b>0.11</b>	

Instructor/Term Detail is provided below.

## Group A - Fall-Spring Pre-Clickers

### Spring 2004

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	3	38	14.7	44	17.1	62	24.0	28	10.9	28	10.9	2	56	21.7	258	55.8	78.3	2.20
All Other Instructors	11	51	8.2	119	19.1	126	20.3	43	6.9	80	12.9	3	200	32.2	622	47.6	67.8	2.09
Total/Average	14	89	10.1	163	18.5	188	21.4	71	8.1	108	12.3	5	256	29.1	880	50.0	70.9	2.13

### Fall 2004

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
All Other Instructors	16	73	13.1	114	20.4	130	23.3	38	6.8	66	11.8	1	137	24.5	559	56.7	75.5	2.29

### Spring 2005

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	3	21	13.2	30	18.9	29	18.2	13	8.2	8	5.0	0	58	36.5	159	50.3	63.5	2.44
All Other Instructors	11	46	9.0	95	18.6	108	21.2	38	7.5	38	7.5	0	185	36.3	510	48.8	63.7	2.26
Total/Average	14	67	10.0	125	18.7	137	20.5	51	7.6	46	6.9	0	243	36.3	669	49.2	63.7	2.31

### Fall 2005

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	3	19	17.0	20	17.9	17	15.2	19	17.0	10	8.9	0	27	24.1	112	50.0	75.9	2.23
All Other Instructors	12	106	19.5	104	19.1	122	22.4	27	5.0	34	6.3	5	146	26.8	544	61.0	73.2	2.61
Total/Average	15	125	19.1	124	18.9	139	21.2	46	7.0	44	6.7	5	173	26.4	656	59.1	73.6	2.54

## Group B - Fall-Spring After Clicker Implementation

### Spring 2006

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	4	18	9.6	31	16.6	52	27.8	20	10.7	13	7.0	0	53	28.3	187	54.0	71.7	2.16
All Other Instructors	9	67	15.2	64	14.5	99	22.4	27	6.1	33	7.5	7	145	32.8	442	52.0	67.2	2.41
Total/Average	13	85	13.5	95	15.1	151	24.0	47	7.5	46	7.3	7	198	31.5	629	52.6	68.5	2.34

**Fall 2006**

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	3	21	17.1	22	17.9	31	25.2	11	8.9	2	1.6	0	36	29.3	123	60.2	70.7	2.56
All Other Instructors	12	106	17.5	130	21.4	120	19.8	42	6.9	44	7.2	0	165	27.2	607	58.6	72.8	2.54
Total/Average	15	127	17.4	152	20.8	151	20.7	53	7.3	46	6.3	0	201	27.5	730	58.9	72.5	2.55

**Spring 2007**

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	4	14	12.7	19	17.3	52	47.3	9	8.2	1	0.9	0	15	13.6	110	77.3	86.4	2.48
All Other Instructors	11	90	17.7	104	20.4	92	18.1	41	8.1	40	7.9	0	142	27.9	509	56.2	72.1	2.50
Total/Average	15	104	16.8	123	19.9	144	23.3	50	8.1	41	6.6	0	157	25.4	619	59.9	74.6	2.48

**Group C - Summer Pre-Clickers****Summer 2003**

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	1	24	27.3	14	15.9	18	20.5	2	2.3	2	2.3	0	28	31.8	88	63.6	68.2	2.93
All Other Instructors	3	16	16.2	34	34.3	36	36.4	2	2.0	4	4.0	0	7	7.1	99	86.9	92.9	2.61
Total/Average	4	40	21.4	48	25.7	54	28.9	4	2.1	6	3.2	0	35	18.7	187	75.9	81.3	2.76

**Summer 2004**

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
All Other Instructors	4	42	22.3	64	34.0	39	20.7	10	5.3	10	5.3	1	22	11.7	188	77.1	88.3	2.76

**Summer 2005**

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
All Other Instructors	4	29	17.9	41	25.3	44	27.2	10	6.2	7	4.3	1	30	18.5	162	70.4	81.5	2.61

## Group D - Summer After Clicker Implementation

### Summer 2006

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	1	34	39.5	10	11.6	18	20.9	14	16.3	8	9.3	0	2	2.3	86	72.1	97.7	2.57
All Other Instructors	2	20	25.0	19	23.8	24	30.0	2	2.5	4	5.0	0	11	13.8	80	78.8	86.3	2.71
Total/Average	3	54	32.5	29	17.5	42	25.3	16	9.6	12	7.2	0	13	7.8	166	75.3	92.2	2.62

### Summer 2007

Instructor	Sections	A		B		C		D		F		I	W		Total Enrolled	Success (%)	Retention (%)	GPA
		n	%	n	%	n	%	n	%	n	%	n	n	%				
Mr. David J. Vakil	1	20	28.6	12	17.1	26	37.1	4	5.7	0	0.0	0	8	11.4	70	82.9	88.6	2.77
All Other Instructors	3	53	35.1	53	35.1	22	14.6	3	2.0	11	7.3	0	9	6.0	151	84.8	94.0	2.93
Total/Average	4	73	33.0	65	29.4	48	21.7	7	3.2	11	5.0	0	17	7.7	221	84.2	92.3	2.88