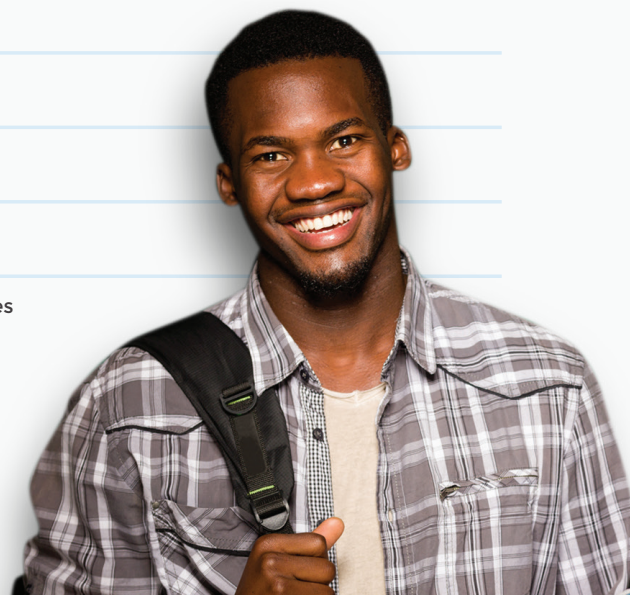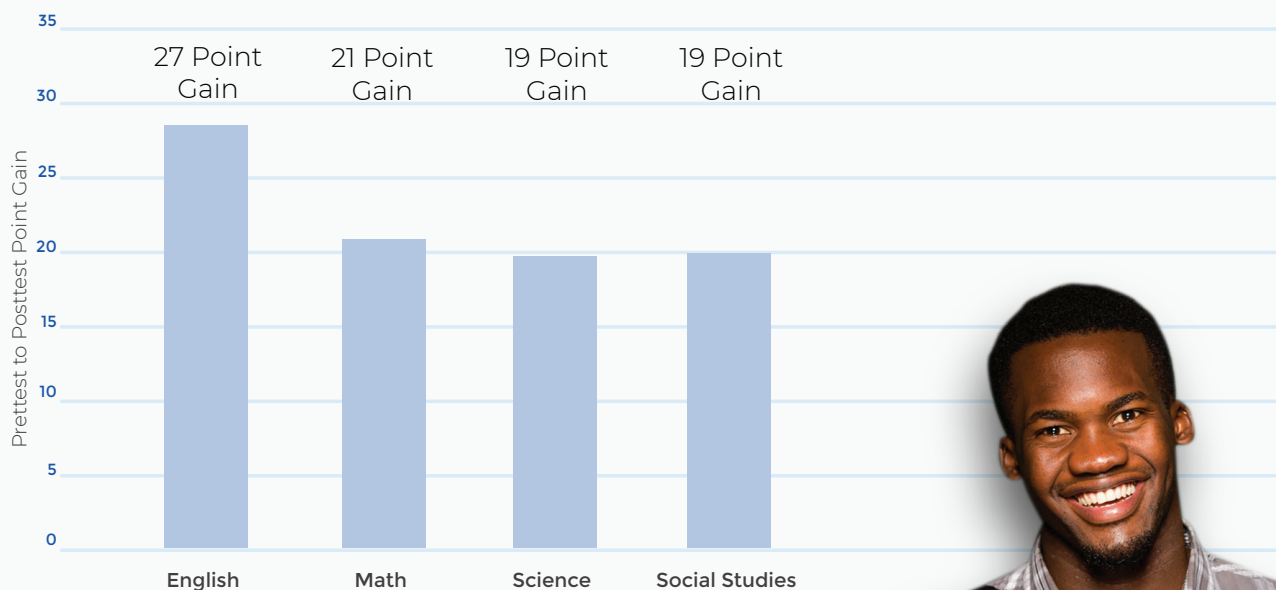# Three Years of Gain: The Impact of Apex Learning Tutorials on High School Student Achievement

School Years 2016-2017 through 2018-2019

October 2019

Introduction: Apex Learning Tutorials

Apex Learning Tutorials prepare high school students to master grade-level content with standards-based instruction and support for students who struggle with on-grade instruction. Instruction is delivered in discrete modules addressing specific concepts, and modules are grouped into units of related concepts. Students may complete only those modules that address one or more specific standards or complete all modules in Tutorials for a subject area.

Tutorials provide a personalized learning path for each student. Unit-level pretests prescribe a plan of instruction to meet students' individual learning needs, and students struggling with grade-level concepts are prescribed remedial instruction of skills down to the third-grade level. The learning path continually adapts as each student progresses through each module.

Embedded pretest, Test It, and posttest assessments provide performance data by module, unit, or standard, quickly identifying where students have demonstrated content mastery and where they still need to focus their learning.

Purpose of Study

The purpose of this study is to investigate the impact of Apex Learning high school Tutorials on student learning over the course of three school years. The analysis addresses two questions:

- What impact does Tutorials use make on achievement gain from pretest to posttest?
- Are achievement gains consistent across years?

The results of 648,572 Tutorials modules with pretest, Test It, and posttest scores across three school years were included in the analytical dataset. Analysts addressed each question by subject and school year and reported the findings by subject. Tables showing descriptive statistics and the results for all statistical tests are located in the appendix.

Key Findings

Apex Learning Tutorials significantly improved student performance on Tutorials posttest assessments across English, math, science, and social studies for three straight years.

Tutorials had a statistically significant impact on student posttest achievement compared to pretest performance for all school years by subject. Results of paired-samples t-tests (Table 2, appendix) suggested that by subject, the average gain across school years for English was 74%, followed by math at 58%, science at 55%, and social studies at 50%. By school year and subject, Tutorials posttest scores improved between 49% and 79%.

The average gain by subject was consistent across years fluctuating between +/-.18 and +/-2.09 percentage points. For English, math, and science, the results of one-way ANOVAs (Table 3 appendix)

suggested that gains made in the 2017-2018 and 2018-2019 school years were similar to each other and statistically greater than gains made in 2016-2017. For social studies, the average gain made in 2017-2018 was two percentage points greater than gains made in 2016-2017 and 2018-2019.

The average pretest, posttest, and percentage point gain by subject and school year are reported by subject under each heading.
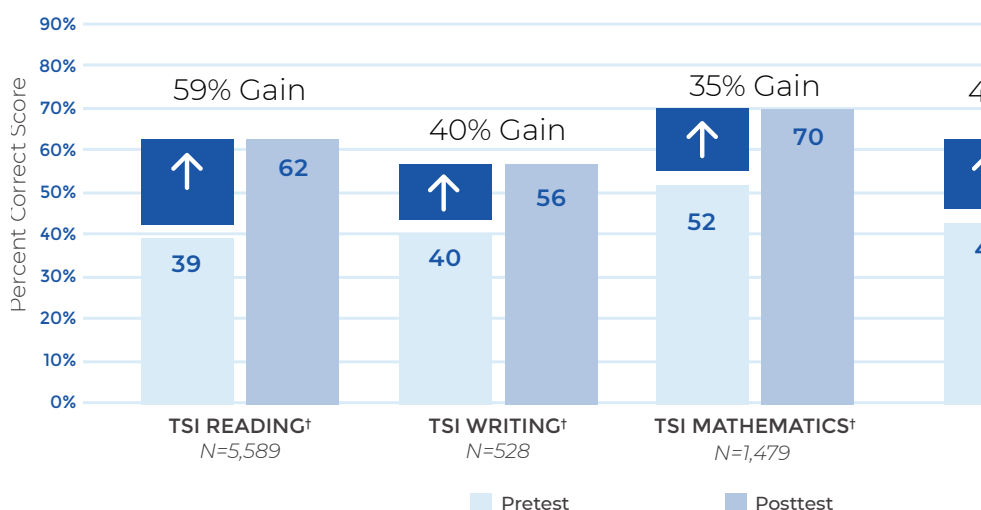
English Tutorials

Following the use of English Tutorials:

- Tutorials gains from pretest and posttest score ranged from 26 to 27 points over three years. Relative to pretest performance, the gains are equal to a 72%, 79%, and 77% improvement for 2016-2017, 2017-2018, and 2018-2019 respectively. Over the three-year span, the average gain was 74%.

- The magnitude of the effect of Tutorials use on posttest achievement was large for all three school years (d=.92, .95, .95 respectively).

- Over the course of three years, the average gain between pretest and posttest was significantly greater in the last two school years (2017-2018 and 2018-2019) than in the first school year. The average gain between pre- and posttest in school years 2017-2018 and 2018-2019 was 27 points compared to 26 points from the year prior (2016-2017).

Figure 1 shows the average pretest score, posttest score, and gain following use of English Tutorials.

Figure 1
Average Percent Correct Score Gain

†Differences between pre- and posttest for each school year are statistically significant. (Sig. p<.001).

††Gains made from 2017-2018 and 2018-2019 are significantly greater than those made in 2016-2017 (Sig. p<.05).

Note: The number of modules included in the analysis ranges from 69,310 to 268,065 by school year.
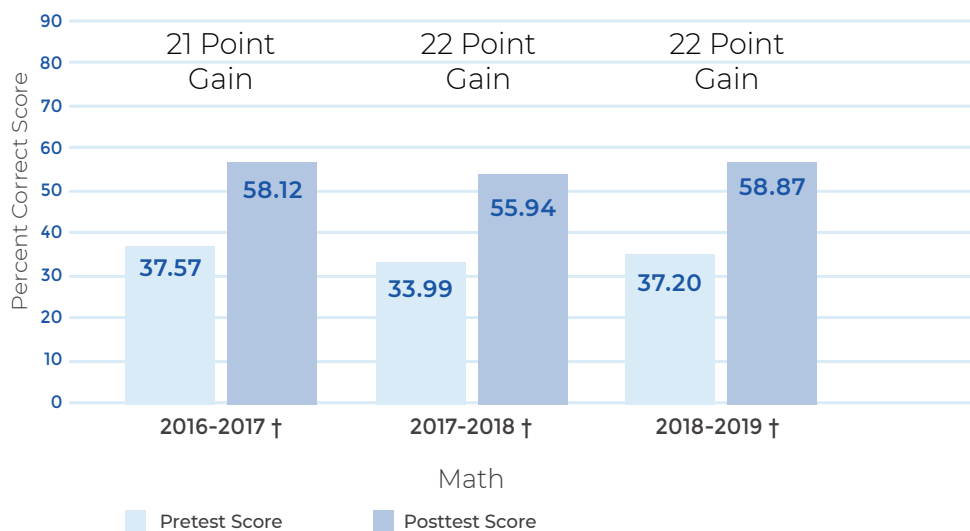
Math Tutorials

Following the use of math Tutorials:

- Tutorials gains from pretest and posttest score ranged from 21 to 22 points over three years. Relative to pretest performance, the gains are equal to a 55%, 65%, and 58% improvement for 2016-2017, 2017-2018, and 2018-2019 respectively. Over the three-year span, the average gain was 58%.

- The magnitude of the effect of Tutorials use on posttest achievement ranged from moderate to large across school years (d=.79, .88, .84 respectively).

- Over the course of three years, the average gain between pretest and posttest was significantly greater in the last two school years (2017-2018 and 2018-2019) than in 2016-2017. The average gain between pre- and posttest in school years 2017-2018 and 2018-2019 was 22 points compared to 21 points from the year prior (2016-2017).

Figure 2 shows the average pretest score, posttest score, and gain following use of math Tutorials.

Figure 2
Average Pretest, Posttest, and Percentage Point Gain: Math

†Differences between pre- and posttest for each school year are statistically significant. (Sig. p<.001).

††Gains made from 2017-2018 and 2018-2019 are significantly greater than those made in 2016-2017 (Sig. p<.05).

Note: The number of modules included in the analysis ranges from 29,007 to 42,266 by school year.
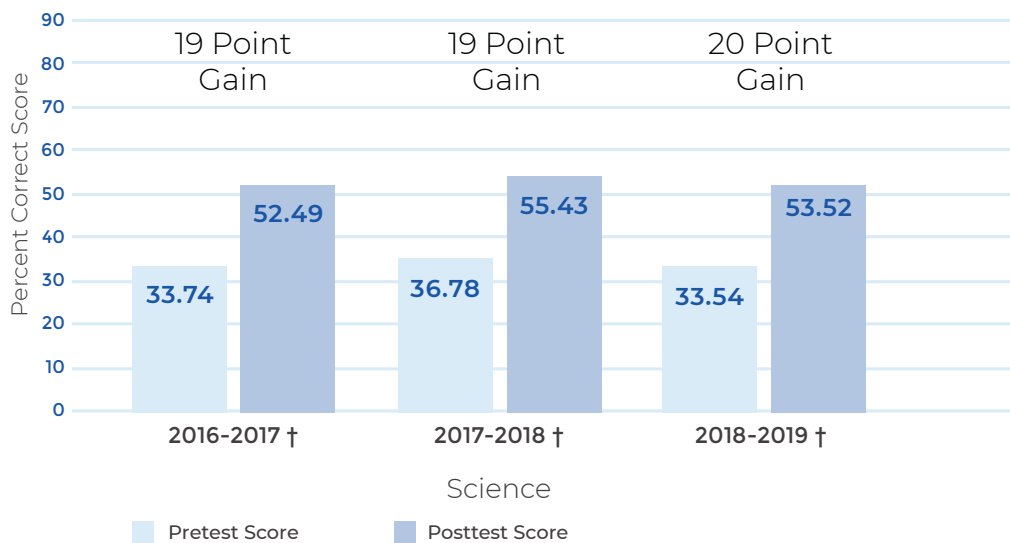
Science Tutorials

Following the use of science Tutorials:

- Tutorials gains from pretest and posttest score ranged from 19 to 20 points over three years. Relative to pretest performance, the gains are equal to a 56%, 51%, and 60% improvement for 2016-2017, 2017-2018, and 2018-2019 respectively. Over the three-year span, the average gain was 55%.

- The magnitude of the effect of Tutorials use on posttest achievement was moderate for all three school years (d=.74, .71, .79 respectively).

- Over the course of three years, the average gain between pretest and posttest was significantly greater in 2018-2019 than the two years prior. The average gain between pre- and posttest in school year 2018-2019 was 20 points compared to 19 points in 2016-2017 and 2017-2018.

Figure 3 shows the average pretest score, posttest score, and gain following use of science Tutorials.

Figure 3

Average Pretest, Posttest, and Percentage Point Gain: Science

†Differences between pre- and posttest for each school year are statistically significant. (Sig. $p<.001$

††Gain made in 2018-2019 is significantly greater than gain made in 2016-2017 and 2017-2018 (Sig. $p<.05$).

Note: The number of modules included in the analysis ranges from 16,023 to 31,084 by school year.

Social Studies Tutorials

Following the use of social studies Tutorials:

- Tutorials gains from pretest and posttest score ranged from 19 to 21 points over three years. Relative to pretest performance, the gains are equal to a 49%, 54%, and 49% improvement for 2016-2017, 2017-2018, and 2018-2019 respectively. Over the three-year span, the average gain was 50%.

- The magnitude of the effect of Tutorials use on posttest achievement ranged from moderate to large for all three school years (d=.74, .80, .73 respectively).

- Over the course of three years, the average gain between pretest and posttest was significantly greater in 2017-2018 than in 2016-2017 and 2018-2019. The average gain between pre- and posttest in school year 2017-2018 was 21 points compared to 19 in 2016-2017 and 2018-2019.

Figure 4 shows the average pretest score, posttest score, and gain following use of social studies Tutorials.

Figure 4

Average Pretest, Posttest, and Percentage Point Gain: Social Studies
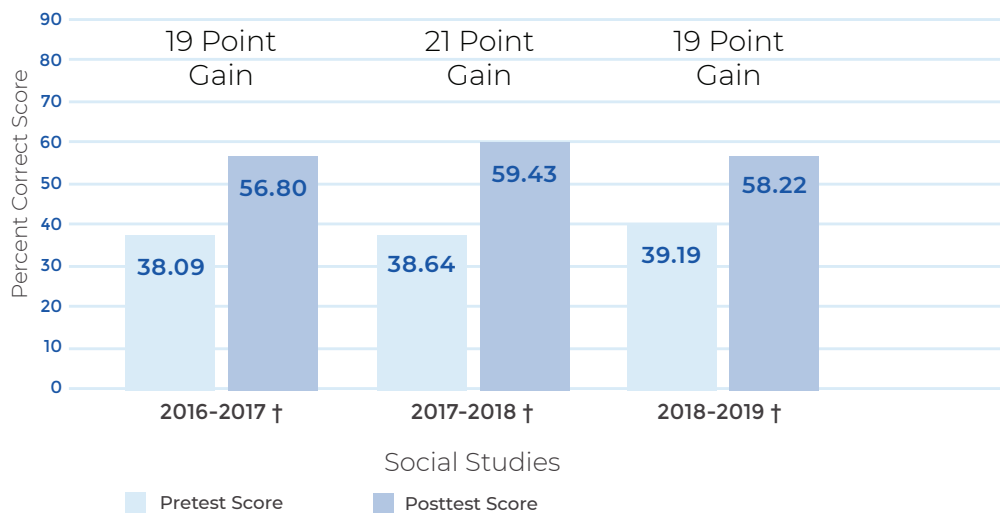
†Differences between pre- and posttest for each school year are statistically significant. (Sig. p<.001

††Gain made in 2017-2018 is significantly greater than gain made in 2016-2017 and 2018-2019 (Sig. p<.05).

Note: The number of modules included in the analysis ranges from 12,560 to 22,607 by school year.

Study Description

Study Design

A pretest/posttest single group design was used to evaluate the impact of Tutorials use on posttest performance.

Participants

Students from across the nation used over one million high school Tutorials modules. Student enrollments with completed unit pretests, 100% of unit modules, and unit posttests were included in analytical dataset.

Data Preparation

Apex Learning provided 2,422,630 records of student level module data including enrollment ID number, subject, Tutorials name, unit name, module name, and pretest, Test It, and posttest scores. Unit level pretest and posttest scores were distributed across modules by corresponding objectives. Twenty-seven percent (27%) of modules containing pretest, Test It, and posttest scores were included in the analytical dataset.

Analysis

A paired-samples t-test was used to determine if the average module posttest score was significantly greater than the average module pretest score by year for each subject. Cohen's d was used as a measure of effect size.

A one-way ANOVA was used by subject to determine if achievement gains were significantly different between years, and post-hoc Scheffe tests were used to identify school years that differed significantly among years.

Limitations

A single group design was used to analyze the impact of Tutorials use on pretest to posttest gain. Single group design studies are limited by not having a comparison group to control for events unrelated to the intervention that could impact posttest performance. Events unrelated to the intervention include participant maturation, testing, instrument decay, and regression to the mean.

Outcome Measures

The outcome measure used in this study is the Tutorials posttest score reported at the module level.

Appendix

Table 1. Module Level Descriptive Statistics								
School Year	Subject	Modules	Pretest Score		Test It Score		Posttest Score	
		N	Mean	SD	Mean	SD	Mean	SD
2016-2017	English	268,065	36.77	28.64	69.34	29.23	63.22	33.20
	Math	42,266	37.57	25.97	63.28	27.36	58.12	29.62
	Science	31,084	33.74	25.50	62.35	28.25	52.49	29.07
	Social Studies	22,607	38.09	25.24	64.23	28.39	56.80	29.33
	Total	364,022	36.68	27.90	67.73	29.01	61.31	32.42
2017-2018	English	86,842	34.71	28.97	69.65	29.99	62.13	33.59
	Math	29,007	33.99	24.94	59.86	27.64	55.94	29.13
	Science	24,321	36.78	26.26	64.11	27.05	55.43	28.27
	Social Studies	12,730	38.64	25.95	65.49	28.62	59.43	29.28
	Total	152,900	35.23	27.61	66.57	29.25	59.66	31.77
2018-2019	English	69,310	35.36	28.55	68.22	30.63	62.59	33.77
	Math	33,757	37.20	25.90	64.76	27.73	58.87	30.07
	Science	16,023	33.54	25.18	61.02	27.2	53.52	28.67
	Social Studies	12,560	39.19	25.90	67.84	28.48	58.22	29.56
	Total	131,650	35.98	27.29	66.42	29.41	60.12	32.01
Total	English	424,217	36.12	28.71	69.22	29.62	62.89	33.38
	Math	105,030	36.46	25.71	62.81	27.62	57.76	29.65
	Science	71,428	34.73	25.73	62.65	27.64	53.72	28.74
	Social Studies	47,897	38.52	25.61	65.51	28.51	57.87	29.39
	Total	648,572	36.20	27.71	67.19	29.16	60.68	32.19

Table 2. Paired-Samples T-Test Results

Subject	School Year	Pretest Score Mean	Posttest Score Mean	Paired Differences	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)	Effect Size d
English	2016-2017	36.77	63.22	26.45	39.05	0.08	350.69	268064	0.00	0.92
	2017-2018	34.71	62.13	27.41	39.71	0.13	203.42	86841	0.00	0.95
	2018-2019	35.36	62.59	27.23	39.19	0.15	182.96	69309	0.00	0.95
Math	2016-2017	37.57	58.12	20.55	32.60	0.16	129.61	42264	0.00	0.79
	2017-2018	33.99	55.94	21.95	33.06	0.19	113.09	29004	0.00	0.88
	2018-2019	37.20	58.87	21.67	32.35	0.18	123.08	33756	0.00	0.84
Science	2016-2017	33.74	52.49	18.76	31.94	0.18	103.53	31083	0.00	0.74
	2017-2018	36.78	55.43	18.64	31.99	0.21	90.89	24320	0.00	0.71
	2018-2019	33.54	53.52	19.98	32.52	0.26	77.76	16022	0.00	0.79
Social Studies	2016-2017	38.09	56.80	18.71	32.69	0.22	86.05	22606	0.00	0.74
	2017-2018	38.64	59.43	20.80	32.78	0.29	71.59	12729	0.00	0.80
	2018-2019	39.19	58.22	19.02	32.58	0.29	65.43	12559	0.00	0.73
Total	English	36.12	62.89	26.78	39.21	0.06	444.75	424216	0.00	0.93
	Math	36.46	57.76	21.30	32.65	0.10	211.39	105026	0.00	0.83
	Science	34.73	53.72	18.99	32.09	0.12	158.16	71427	0.00	0.74
	Social Studies	38.52	57.87	19.34	32.69	0.15	129.49	47896	0.00	0.76

† Statistically significant, p < .05

Table 3. One-way ANOVA Results

Subject		Sum of Squares	df	Mean Square	F	Sig.
English	Between Groups	77893.264	2	38946.632	25.331	.000
	Within Groups	652230767.294	424214	1537.504		
	Total	652308660.558	424216			
Math	Between Groups	40724.250	2	20362.125	19.106	.000
	Within Groups	111928451.064	105024	1065.742		
	Total	111969175.314	105026			
Science	Between Groups	20241.807	2	10120.903	9.828	.000
	Within Groups	73552135.870	71425	1029.781		
	Total	73572377.677	71427			
Social Studies	Between Groups	37425.861	2	18712.931	17.519	.000
	Within Groups	51159151.525	47894	1068.175		
	Total	51196577.386	47896			

Table 4. Scheffe Test Results							
Subject	(I) School Year	(J) School Year	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
English	2016-2017	2017-2018	-.96181*	.15310	.000	-1.3366	-.5871
		2018-2019	-.78022*	.16709	.000	-1.1892	-.3712
	2017-2018	2016-2017	.96181*	.15310	.000	.5871	1.3366
		2018-2019	.18159	.19972	.661	-.3073	.6705
	2018-2019	2016-2017	.78022*	.16709	.000	.3712	1.1892
		2017-2018	-.18159	.19972	.661	-.6705	.3073
Math	2016-2017	2017-2018	-1.40079*	.24892	.000	-2.0101	-.7915
		2018-2019	-1.12181*	.23830	.000	-1.7051	-.5385
	2017-2018	2016-2017	1.40079*	.24892	.000	.7915	2.0101
		2018-2019	.27898	.26137	.566	-.3608	.9188
	2018-2019	2016-2017	1.12181*	.23830	.000	.5385	1.7051
		2017-2018	-.27898	.26137	.566	-.9188	.3608
Science	2016-2017	2017-2018	.11400	.27472	.918	-.5585	.7865
		2018-2019	-1.22054*	.31209	.000	-1.9845	-.4566
	2017-2018	2016-2017	-.11400	.27472	.918	-.7865	.5585
		2018-2019	-1.33454*	.32651	.000	-2.1338	-.5353
	2018-2019	2016-2017	1.22054*	.31209	.000	.4566	1.9845
		2017-2018	1.33454*	.32651	.000	.5353	2.1338
Social Studies	2016-2017	2017-2018	-2.09221*	.36216	.000	-2.9787	-1.2057
		2018-2019	-.31588	.36372	.686	-1.2062	.5745
	2017-2018	2016-2017	2.09221*	.36216	.000	1.2057	2.9787
		2018-2019	1.77634*	.41104	.000	.7702	2.7825
	2018-2019	2016-2017	.31588	.36372	.686	-.5745	1.2062
		2017-2018	-1.77634*	.41104	.000	-2.7825	-.7702

*The mean difference is significant at the 0.05 level.

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