



Efficacy of TILT Tutoring Program AY 2015-2017

The Institute for Learning and Teaching (TILT) provided academic support via the tutoring program to 4,733 unique students (7,236 cases of students participating in tutoring for distinctive courses) for forty-six undergraduate courses over the two academic years.¹ To quantify the efficacy of the tutoring program, the current analysis compares course grades of tutoring program participants to non-participants enrolled in those courses. Additionally, a regression analysis was completed to assess whether course grades could be predicted by program participation after controlling for academic preparation (CCHE Index). Please contact Institutional Research, Planning & Effectiveness should you have any questions or comments regarding this analysis.

Executive Summary

Looking at all courses that offered tutoring programs for the 2015-2017 academic year, students, on average, who participated in tutoring programs did not significantly differ by course grade (mean = 2.56) when compared to non-tutoring participants (mean = 2.58). A partial explanation of this finding could be students who participate in tutoring typically have lower index scores (mean = 113.34) than those who do not participate (mean = 114.94). Therefore, results were examined after controlling for students' index scores.

Overall, tutoring participants did not earn higher course grades than non-tutoring participants when controlling for index (i.e. isolating the impact tutoring participation has on course grade). However, a positive relationship between tutoring participation and course grade did appear among most course fields when examined in aggregate. Tutoring participants in Chemistry, Economics, Biology, Physics, and Statistics courses all had significantly higher course grades after controlling for index than non-tutoring participants. Although the individual math courses that were significant indicated a positive relationship between tutoring participants and course grade, the overall Math field (all math courses combined) had significantly lower course grades than non-tutoring participants even after controlling for index.

At the individual course level over both academic years, tutoring participants had significantly higher average course grades than non-tutoring participants in the following courses: BZ 350, CHEM 245, CHEM 341, ECON 204, MATH 101 and PH 121, with the largest mean differences occurring in BZ 350 and MATH 101. Conversely, non-tutoring participants had significantly higher course grades than tutoring participants in CHEM 113, MATH 117, and STAT 204 with the greatest association emerging for MATH 117.

¹ There were 9,757 cases initially reported; however, 2,521 cases were removed (divided pretty evenly over the four terms). Cases were removed if students were not enrolled in a course that matched the tutoring course they attended for that term. Additionally, cases were removed if the student id numbers were not accurate.



Frequency of tutoring visits was also a significant variable. For the 2016-2017 academic year, the number of tutoring visits positively and significantly impacted course grade after controlling for a student's index among tutoring participants. However, there was no significant relationship between number of visits and course grade after controlling for index for 2015-2016 academic year. On average, students attended tutoring for a course 4.01 times. This was lower in AY 2016-17 (mean = 3.87) than in AY 2015-2016 (mean = 4.17).

Looking at tutoring participants in the 2015-2017 academic years, the number of tutoring visits significantly, and positively, impacted course grade at the individual course level above and beyond index score for BZ 350, CHEM 111, CHEM 245, CHEM 341, LIFE102, MATH 155, and PH 142. When examining courses in aggregate by field, controlling for index, frequency of tutoring visits positively impacted course grades in Biology, Chemistry, and Physics courses. However frequency of tutoring visits was not significantly related to course grade for BMS, ECON, or STAT courses after controlling for students' index scores.

When examining who attends tutoring, the tutoring program is well attended by females and underrepresented race and/or ethnicity. Compared to non-tutoring participants in the courses with tutoring opportunities, females, sophomores, STEM majors, and students of an underrepresented race and/or ethnicity were over represented in tutoring. First generation students were similarly represented in both groups.

Generally, there is some evidence that tutoring participation has a positive impact on student's course grade; yet, the direction of this impact and magnitude continues to vary by course as previous years have also indicated.



Notes for Interpreting the Results:

- Course grade and grade points can be interpreted as follows: A = 4.0, B = 3.0, C = 2.0, D = 1.0, F/U = 0. Course grades were collapsed into whole grades for summary purposes. For example, course grades of B+ and B- were categorized as 'B' (see Figures 2a-c).
- Course level analyses are limited due to the small number of tutoring participants. Please interpret results with extreme caution and note the small sample sizes may not yield significant results even if there may be an effect. Courses were combined when possible over both terms and/or when within the same department.
- Results yielding a p-value of .05 are considered statistically significant. Due to the large group discrepancies and small number of tutoring participants, using a less stringent standard of a .10 p-value may provide further insight into the programs. An italicized p-value indicates tutoring participation is a statistically significant predictor of course grade above and beyond index level at the $p < .10$ level (see Tables 2 and 3).
- For a statistically significant result, an effect size, reported as Cohen's d, is included. An effect size is a standardized measure that describes the magnitude of the difference between the two group means. This allows for a practical interpretation for understanding to what extent the two groups differ. Although there is no objective rule, Cohen (1988) suggests the following guide for interpreting an effect size: small = .20, moderate = .50, large = .80 (Tables 1a-c).
- The beta coefficient, B, represents the association between course grade and tutoring participation after controlling for CCHE index. For instance, a coefficient of .50 would indicate tutoring participation results in an average increase of .50 points in their final course grade after controlling for a student's index (see Tables 2 and 3).
- R-squared is a statistical measure used to explain the percentage of the variation in course grades described by the two variables included in the model: tutoring participation and index. An R-squared of 0% indicates the two variables in the model explain none of the variability in the response data around the mean, while 100% indicates the model explains all of the variability of the respondent data around the mean. For these results, R-squared is relatively low for all models. This indicates there are likely other predictors besides index and tutoring program participation explaining one's course grade. This is not an unexpected finding since a multitude of student characteristics and college experiences play a role in student grade performance (see Tables 2 and 3).



1. Research Question: What are the demographic characteristics of students who participate in the tutoring program compared to students who do not participate?

Among all courses who offered tutoring over the two academic years there were 7,236 students who participated in TILT’s tutoring program distinct to an individual course (AY15: 3,276 & AY16: 3,960). Frequently, students attended multiple courses for tutoring. There were 4,733 students who participated in the tutoring program (AY15: 2,398 and AY16: 2,969) (see Figure 1).

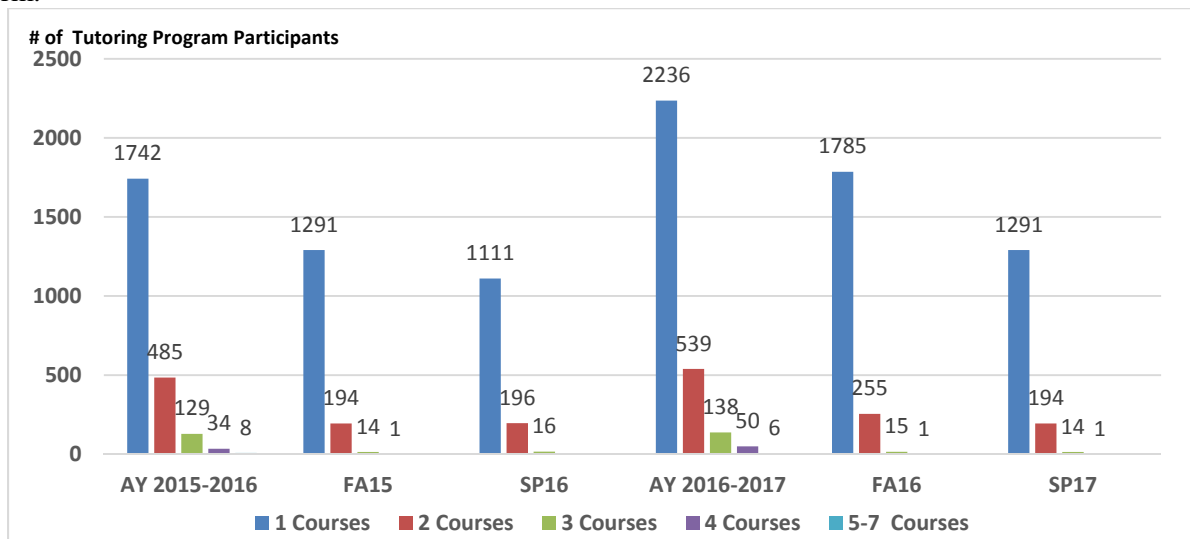
Compared to non-tutoring participants in the courses with tutoring opportunities, females, sophomores, STEM majors, and students of an underrepresented race and/or ethnicity were overrepresented in tutoring. Among program participants over both academic years, about 59% of tutoring participants were women and 24% were of a minority race or ethnicity (non-tutoring participants: 49%, and 20% respectively). A quarter of tutoring participants were first generation, which is comparable to non-tutoring participants (25%).

The majority (57%) of tutoring participants had a STEM major (compared to 47% of non-tutoring participants). Almost a quarter (24%) of tutoring participants had a major in the College of Natural Sciences, while a fifth (21%) had a major in the Health and Human Sciences (compared to 22% and 21% respectively for non-tutoring participants). Less than 12% of tutoring participants had majors in Intra University (12%), Engineering (12%), Warner College of Natural Resources (9%), CVMBS (7%), Agricultural Sciences (6%), Business (5%), and Liberal Arts (5%) (Non-tutoring participants: 15%, 12%, 7%, 4%, 7%, 7%, and 8% respectively).

Sophomores and freshmen were well represented in the tutoring program. About a third of participants were sophomores, while 29% are freshman (29% and 22% of non-tutoring participants respectively). Juniors (22% for both) and seniors (tutoring: 16% and non-tutoring: 17%) were represented comparably among tutoring and non-tutoring participants.

See Tables 4-8 in Appendix to view demographics by academic year.

Figure 1. Number of tutoring participants receiving services for multiple courses by academic year and term.





2. Research Question: Do students who participate in the TILT tutoring programs earn higher course grades than those students who do not participate?

Looking at all courses that offered tutoring programs for the 2015-2017 academic year, students who participated in tutoring programs did not significantly differ in their course grades on average (mean = 2.56) when compared to non-tutoring participants (mean = 2.58) ($p = .21$). However, significance differences emerged in both academic years, but in opposite directions. In AY15-16, non-tutoring participants had significantly higher course grades on average (mean = 2.60) than tutoring participants (mean = 2.50) ($p < .01$, $d = .09$); however, in AY16-17, tutoring participants actually had higher course grades on average (mean = 2.60) compared to non-tutoring participants (mean = 2.55) ($p = .02$, $d = .04$).

About a third of tutoring participants received a B in their course and about a fifth received an A (compared to 28% and 26% of non-tutoring participants respectively). Tutoring participants received less F's, U's and W's compared to non-tutoring participants (see Figure 2c).

At the individual course level over both academic years, tutoring participants had significantly higher average course grades than non-tutoring participants in the following courses: BZ 350, CHEM 245, CHEM 341, ECON 204, MATH 101 and PH 121. The courses that had the largest effect sizes when comparing the course grade points were BZ 350 and MATH 101 ($d = .31$ and $.37$ respectively). Conversely, non-tutoring participants had significantly higher course grades than tutoring participants in CHEM 113 and STAT 204.

Over both academic years, non-tutoring participants had significantly higher average index scores (mean = 114.94) than tutoring participants (mean = 113.34) ($p < .01$, $d = .12$) and non-tutoring participants had significantly higher index scores than tutoring participants for twenty-five of the thirty-nine courses tested (effect sizes were primarily moderate). Tutoring participants did not have significantly higher index scores than non-tutoring participants in any of the courses. This suggests, on average, students who participate in tutoring typically have lower index scores than those who do not participate (see Table 1c). Therefore, in order to isolate the impact tutoring participation has on course grade, it is important to examine tutoring participation and course grade controlling for student's academic index (see Research Question #2 on p.9).

See Tables 1a-c: Cells in orange corresponds to a significant difference in course grade, while cells in green corresponds to a significant difference ($p < .05$) in students' average index.



Figure 2a. Overall Course Grade by Tutoring Participation for AY2015-2016, All Courses

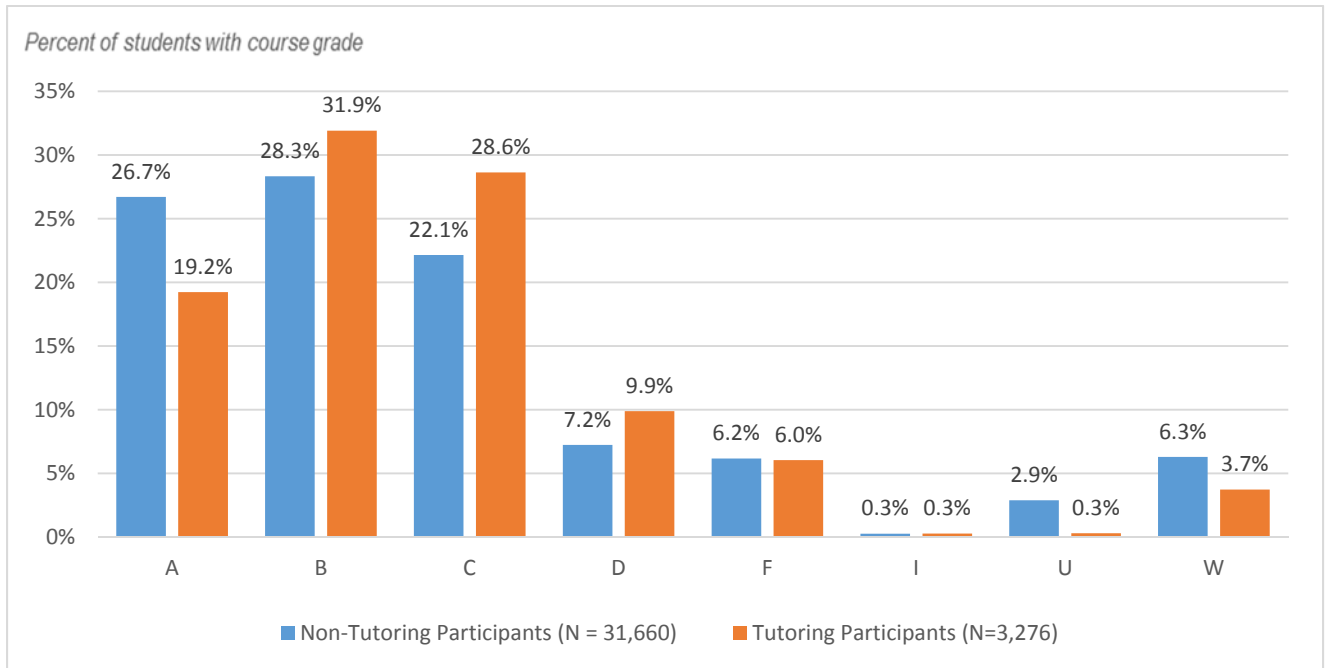


Figure 2b. Overall Course Grade by Tutoring Participation for AY2016-2017, All Courses

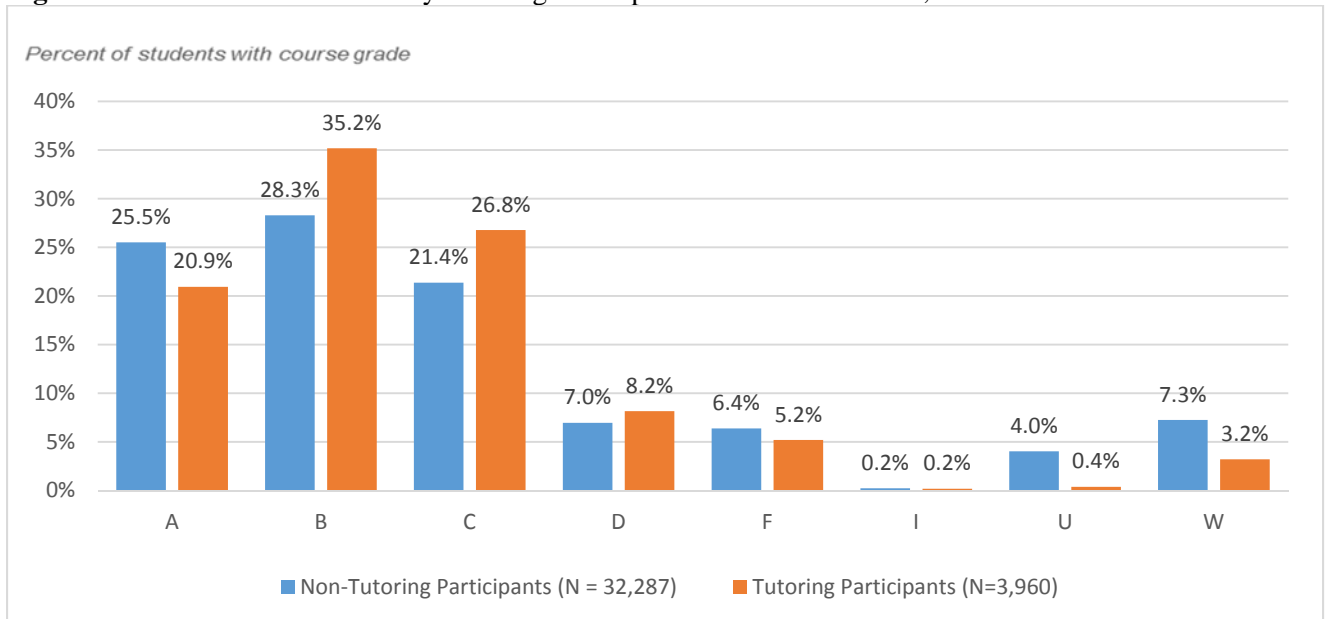




Figure 2c. Overall Course Grade by Tutoring Participation for AY2015-2017, All Courses

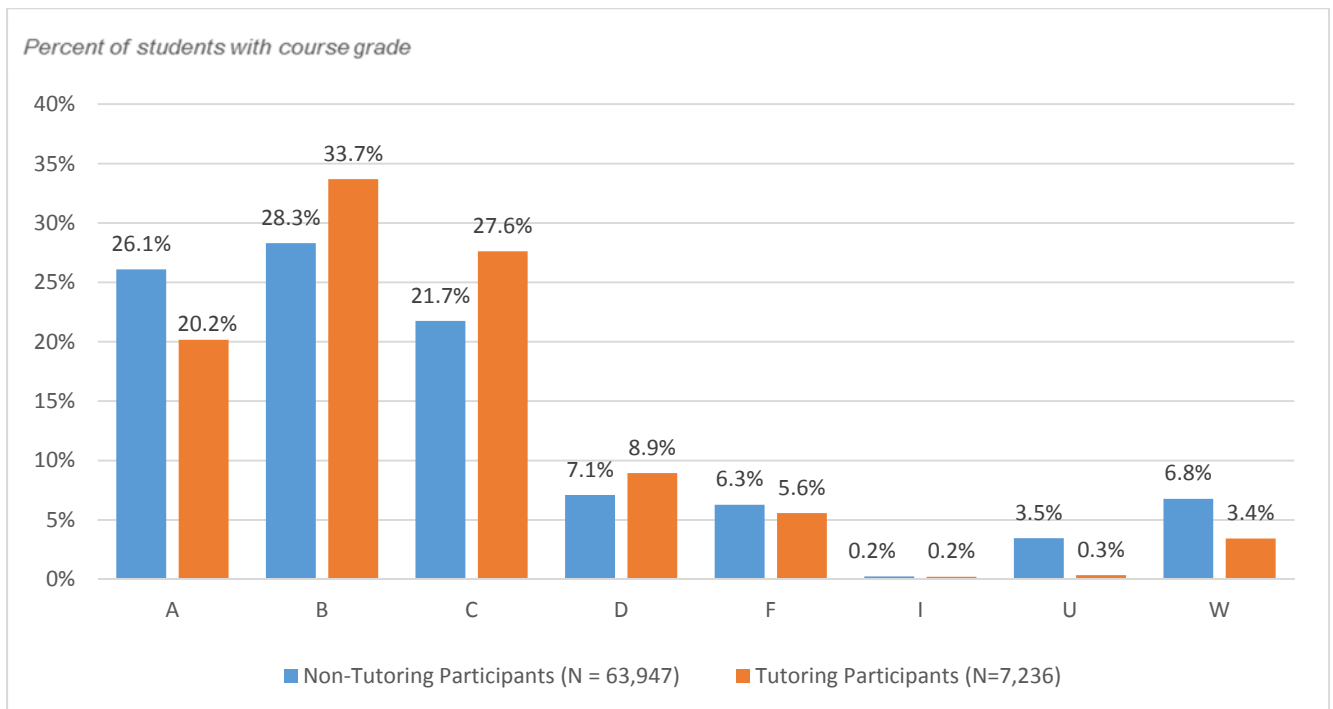




Table 1a. Academic Year 2015-16: Average course grade and CCHE index across tutoring program participant status and course.

AY15-16								
Course	Non-Tutoring Participants			Tutoring Participants			Effect Size	
	#	Average Course Grade	Average CCHE Index	#	Average Course Grade	Average CCHE Index	d-Grade	d-Index
ANEQ305	153	1.81	111.44	13	1.31	112.89	NA	
BC 351	909	2.83	120.65	27	2.63	116.00		
BMS 300	1,280	2.25	115.61	60	2.28	112.46		
BZ 350	185	2.27	120.45	78	2.66	118.35	0.34	
CHEM103	310	2.60	107.58	44	2.59	103.42		
CHEM107	647	2.58	112.43	26	2.76	109.45		
CHEM111	1,803	2.23	118.44	259	2.25	116.84		
CHEM113	1,107	2.39	119.95	169	2.29	116.27		0.28
CHEM245	520	2.31	117.59	110	2.25	114.92		
CHEM341	531	2.17	120.43	132	2.28	116.17		0.30
CHEM343	460	2.37	121.74	84	2.47	121.04		
ECON202	1,756	2.65	113.04	92	2.78	111.83		
ECON204	1,175	2.66	112.59	83	2.83	109.44		0.26
LIFE102	2,072	2.49	114.92	163	2.37	110.07		0.38
LIFE103	693	2.38	117.21	51	2.27	109.80		0.47
LIFE210	240	2.98	123.77	12	2.91	116.45	NA	
LSPA105	60	2.52	108.94	2	2.67	119.50	NA	
LSPA107	87	2.95	113.99	4	2.83	103.75	NA	
LSPA201	106	3.00	117.88	2	2.67	111.00	NA	
LSPA300	116	3.00	118.40	1	3.33	95.00	NA	
MATH101	279	3.16	104.38	61	3.42	101.82	0.27	
MATH117	1,975	2.72	108.92	27	2.52	106.81		
MATH118	2,608	2.79	109.93	17	2.94	109.71	NA	
MATH124	2,236	3.05	111.47	4	1.75	111.33	NA	
MATH125	961	2.65	111.29	8	1.63	101.60	NA	
MATH126	322	2.83	111.28	3	0.00	102.50	NA	
MATH141	1,029	2.40	109.31	239	2.26	107.00		0.18
MATH155	438	2.13	116.18	258	2.19	113.25		0.20
MATH160	709	2.09	117.13	129	1.95	114.63		0.23
MATH161	722	2.52	121.77	123	2.84	117.54	0.27	0.36
MATH255	58	2.39	113.81	18	2.29	115.73	NA	
MATH261	730	2.65	122.24	42	2.79	115.59		0.45
MATH340	615	2.37	122.71	65	2.29	120.50		
MATH369	274	2.86	121.61	47	2.64	114.79		0.50
PH 121	518	2.61	119.15	225	2.75	113.46		0.46
PH 122	446	3.07	121.57	95	3.13	117.16		0.36
PH 141	678	2.62	121.41	157	2.62	119.01		0.19
PH 142	527	2.81	123.42	75	2.92	122.07		
STAT201	707	2.69	110.09	81	2.80	105.28		0.39
STAT204	794	3.04	112.56	48	2.69	108.26	0.35	0.35
STAT301	824	2.86	115.34	142	2.86	110.75		0.32

Notes: (i) Significant mean course differences ($p < .05$) between tutoring participants and non-tutoring participants for average course grade and average CCHE index are highlighted in orange and green cells (respectively).

(ii) Students with course grades of I, S, or W were excluded from all grade point analyses.

(iii) Significant differences were not tested if the course had less than 20 tutoring participants were not tested for significance.



Table 1b. Academic Year 2016-17: Average course grade and CCHE index across tutoring program participant status and course.

AY16-17								
Course	Non-Tutoring Participants			Tutoring Participants			Effect Size	
	#	Average Course Grade	Average CCHE Index	#	Average Course Grade	Average CCHE Index	d-Grade	d-Index
ANEQ305	143	2.06	112.95	7	2.29	107.71	NA	
BC 351	895	2.65	119.31	30	2.77	113.09		0.49
BMS 300	1,276	2.33	115.58	67	2.26	109.80		0.35
BMS 301	355	2.51	118.64	46	2.47	114.11		0.37
BZ 350	218	2.39	120.54	78	2.69	117.72	0.29	
CHEM103	162	2.68	109.97	38	2.68	105.25		
CHEM107	749	2.56	113.27	49	2.59	103.14		0.72
CHEM111	1,613	2.40	119.73	257	2.41	116.97		0.21
CHEM113	1,086	2.27	120.73	235	2.15	116.41		0.33
CHEM245	484	2.39	116.03	162	2.67	114.25	0.26	
CHEM341	494	2.37	120.94	124	2.71	119.44	0.32	
CHEM343	458	2.28	121.63	136	2.39	119.19		
ECON202	952	2.54	113.40	43	2.45	103.00		0.67
ECON204	626	2.61	111.12	17	3.04	109.77	NA	
LIFE102	2,063	2.50	115.38	229	2.53	111.61		0.29
LIFE103	694	2.37	117.52	34	2.36	116.93		
MATH101	618	2.27	106.67	209	2.89	105.04	0.50	
MATH117	1,997	2.68	109.36	57	2.42	106.67		
MATH118	2,690	2.70	110.56	44	3.00	108.45		
MATH124	2,179	2.89	112.03	10	3.33	107.25	NA	
MATH125	1,987	2.54	111.30	30	3.00	106.38		
MATH126	912	2.60	112.56	6	1.60	110.00	NA	
MATH141	993	2.72	109.05	227	2.86	106.73		0.17
MATH155	479	2.17	116.64	244	2.40	114.69	0.18	
MATH160	717	2.12	117.20	106	2.11	113.58		0.26
MATH161	751	2.49	121.54	102	2.34	117.10		0.36
MATH255	59	2.48	118.55	16	2.94	117.55	NA	
MATH261	678	2.63	123.09	68	2.74	118.31		0.41
MATH340	677	2.29	121.93	52	2.18	119.85		
MATH369	320	2.87	121.61	43	2.70	121.52		
PH 121	530	2.70	118.49	286	2.86	116.65	0.17	
PH 122	393	3.16	121.04	101	3.19	118.01		
PH 141	705	2.53	121.53	138	2.47	117.48		0.31
PH 142	608	2.44	121.86	89	2.41	121.89		
STAT201	636	2.77	110.03	153	2.80	105.82		0.33
STAT204	684	2.68	111.72	147	2.63	107.85		0.29
STAT301	853	2.77	115.60	192	2.77	111.47		0.28
STAT307	180	2.84	120.56	35	3.17	111.07		
STAT311	140	2.68	113.32	27	2.72	107.64		
STAT312	172	2.89	114.07	19	2.53	109.40	NA	
STAT315	61	2.83	124.04	7	2.28	116.80	NA	

Notes: (i) Significant mean course differences ($p < .05$) between tutoring participants and non-tutoring participants for average course grade and average CCHE index are highlighted in orange and green cells (respectively).

(ii) Students with course grades of I, S, or W were excluded from all grade point analyses.

(iii) Significant differences were not tested if the course had less than 20 tutoring participants were not tested for significance.



Table 1c. Academic Year 2015-17: Average course grade and CCHE index across tutoring program participant status and course.

AY15-17								
Course	Non-Tutoring Participants			Tutoring Participants			Effect Size	
	#	Average Course Grade	Average CCHE Index	#	Average Course Grade	Average CCHE Index	d-Grade	d-Index
ANEQ305	296	1.94	112.20	20	1.65	110.63		
BC 351	1,804	2.74	119.98	57	2.70	114.58		0.47
BMS 300	2,556	2.29	115.60	127	2.27	111.14		0.30
BMS 301	355	2.51	118.64	46	2.47	114.11		0.37
BZ 350	403	2.34	120.50	156	2.67	118.04	0.31	
CHEM103	472	2.63	108.34	82	2.63	104.28		0.26
CHEM107	1,396	2.57	112.88	75	2.65	105.28		0.52
CHEM111	3,416	2.31	119.05	516	2.33	116.90		0.17
CHEM113	2,193	2.33	120.33	404	2.21	116.35	0.11	0.30
CHEM245	1,004	2.35	116.88	272	2.50	114.55	0.14	0.15
CHEM341	1,025	2.26	120.67	256	2.49	117.76	0.20	0.20
CHEM343	918	2.32	121.68	220	2.42	119.88		
ECON202	2,708	2.61	113.17	135	2.67	108.86		0.31
ECON204	1,801	2.64	112.08	100	2.86	109.49	0.23	
LIFE 102	4,135	2.50	115.15	392	2.47	110.98		0.32
LIFE 103	1,387	2.38	117.37	85	2.30	112.76		0.32
LIFE210	240	2.98	123.77	12	2.91	116.45	NA	
LSPA105	60	2.52	108.94	2	2.67	119.50	NA	
LSPA107	87	2.95	113.99	4	2.83	103.75	NA	
LSPA201	106	3.00	117.88	2	2.67	111.00	NA	
LSPA300	116	3.00	118.40	1	3.33	95.00	NA	
MATH101	897	2.56	105.92	270	3.01	104.36	0.37	
MATH117	3,972	2.71	109.14	84	2.45	106.72	0.34	0.24
MATH118	5,298	2.74	110.25	61	2.98	108.79		
MATH124	4,415	2.97	111.75	14	2.84	108.36	NA	
MATH125	2,948	2.57	111.30	38	2.68	105.55		0.42
MATH126	1,234	2.66	112.26	9	1.14	108.13	NA	
MATH141	2,022	2.56	109.18	466	2.55	106.87		0.17
MATH155	917	2.15	116.42	502	2.29	113.94		0.17
MATH160	1,426	2.10	117.17	235	2.02	114.17		0.24
MATH161	1,473	2.50	121.65	225	2.61	117.34		0.36
MATH255	117	2.44	116.25	34	2.61	116.50		
MATH261	1,408	2.64	122.66	110	2.76	117.30		0.42
MATH340	1,292	2.33	122.30	117	2.24	120.21		
MATH369	594	2.87	121.61	90	2.67	118.10		
PH 121	1,048	2.66	118.82	511	2.81	115.25	0.15	0.29
PH 122	839	3.11	121.32	196	3.16	117.60		0.30
PH 141	1,383	2.57	121.47	295	2.55	118.32		0.25
PH 142	1,135	2.61	122.58	164	2.64	121.97		
STAT201	1,343	2.73	110.06	234	2.80	105.64		0.35
STAT204	1,478	2.88	112.17	195	2.65	107.94	0.22	0.33
STAT301	1,677	2.82	115.47	334	2.81	111.16		0.29
STAT307	180	2.84	120.56	35	3.17	111.07		
STAT311	140	2.68	113.32	27	2.72	107.64		
STAT312	172	2.89	114.07	19	2.53	109.40	NA	
STAT315	61	2.83	124.04	7	2.28	116.80	NA	

Notes: (i) Significant mean course differences ($p < .05$) between tutoring participants and non-tutoring participants for average course grade and average CCHE index are highlighted in orange and green cells (respectively).
(ii) Students with course grades of I, S, or W were excluded from analyses.
(iii) Significant differences were not tested if the course had less than 20 tutoring participants were not tested for significance.



3. Research Question: Does participation in the TILT tutoring program predict a higher course grade after controlling for academic preparation (CCHE Index)?

After noting the statistically significant differences between participants' index scores above, it is of interest to examine the impact of tutoring program when controlling for the impact of index (isolating the unique effect tutoring program on course grade).

Overall, among all courses and both academic years, participation in the tutoring program did not positively predict a higher course grade compared to those students who did not participate when controlling for the association between course grade and index ($B = .03, p = .06$). However, there were significant findings when examining all courses by academic year. In AY15-16 after controlling for academic index, tutoring participants had significantly lower course grades than non-tutoring participants ($B = -.06, p = .02$), but, in AY16-17, tutoring participation significantly and positively predicted course grade when controlling for index ($B = -.10, p < .01$).

When examining courses in aggregate by field (for example, combining ECON 202 and ECON 204 to ECON), tutoring participants in BZ 350, Chemistry, Economics, Biology, Physics, and Statistics courses had significantly higher course grades even after controlling for index than non-tutoring participants. The beta coefficient, B , represents the association between course grade and tutoring participation after controlling for CCHE index. For instance, Economics courses had the largest positive beta coefficient, $.25$, which indicates tutoring participation results in an average increase of $.25$ grade points in their final course grade after controlling for a student's index. Among the significantly positive relationships, statistic courses had the lowest average grade point increase of $.09$.

Despite the positive relationships above, some courses had significantly negative relationships with tutoring participation and course grade. After controlling for index, tutoring participation did not significantly predict course grade among students in BMS courses, Math courses, BC 351, or ANEQ 305 (see Table 2).

Looking at the individual courses, all significant findings indicate a positive relationship between tutoring participation and course grade after controlling for index. Interestingly, although tutoring participation in Math courses had a significantly negative relationship with course grade when controlling for index, all three individual courses (MATH 101, 155, and 161) had a significantly positive relationship with tutoring participation.



Table 2. Academic Year 2015-17: Linear regression results: Predicting final grade points based on tutoring program participation after controlling for CCHE index.

Course (AY15-17)	# Non-Tutoring Participants	# Tutoring Participants	Adj. R ²	B	p
ANEQ305	296	20	0.03	-0.15	0.67
BC 351	1,804	57	0.09	0.05	0.76
BMS	2,911	173	0.14	0.18	0.08
BMS 300	2,556	127	0.14	0.19	0.13
BMS 301	355	46	0.08	0.10	0.58
BZ 350	403	156	0.17	0.45	<0.01
CHEM	10,424	1,825	0.12	0.11	<0.01
CHEM103	472	82	0.12	0.23	0.07
CHEM107	1,396	75	0.10	0.35	0.02
CHEM111	3,416	516	0.23	0.12	0.02
CHEM113	2,193	404	0.16	-0.01	0.88
CHEM245	1,004	272	0.08	0.21	0.01
CHEM341	1,025	256	0.10	0.34	<0.01
CHEM343	918	220	0.08	0.13	0.21
ECON	4,509	235	0.14	0.25	<0.01
ECON202	2,708	135	0.16	0.21	0.02
ECON204	1,801	100	0.10	0.29	0.01
LIFE	5,762	489	0.20	0.11	0.03
LIFE102	4,135	392	0.22	0.10	0.07
LIFE103	1,387	85	0.15	0.11	0.37
LIFE210	240	12			
LSPA	369	9			
LSPA105	60	2			
LSPA107	87	4			
LSPA201	106	2			
LSPA300	116	1			

NA

**Table 2 cont.** Academic Year 2015-17: Linear regression results: Predicting final grade points based on tutoring program participation after controlling for CCHE index.

Course (AY15-17) (cont.)	# Non-Tutoring Participants	# Tutoring Participants	Adj, R ²	B	p
MATH	28,013	2,255	0.03	-0.09	<0.01
MATH101	897	270	0.08	0.47	<0.01
MATH117	3,972	84	0.04	-0.09	0.62
MATH118	5,298	61	0.02	0.34	008
MATH124	4,415	14	NA		
MATH125	2,948	38	0.03	0.31	0.26
MATH126	1,234	9	NA		
MATH141	2,022	466	0.05	0.07	0.32
MATH155	917	502	0.13	0.26	<0.01
MATH160	1,426	235	0.13	-0.05	0.59
MATH161	1,473	225	0.10	0.27	<0.01
MATH255	117	34	0.08	0.24	0.39
MATH261	1,408	110	0.09	0.23	0.06
MATH340	1,292	117	0.05	-0.06	0.67
MATH369	594	90	0.03	-0.12	0.46
PH	4,405	1,166	0.10	0.18	<0.01
PH 121	1,048	511	0.17	0.29	<0.01
PH 122	839	196	0.10	0.11	0.12
PH 141	1,383	295	0.11	0.06	0.42
PH 142	1,135	164	0.07	0.06	0.42
STAT	5,051	851	0.09	0.09	0.03
STAT201	1,343	234	0.10	0.21	0.01
STAT204	1,478	195	0.08	-0.14	0.08
STAT301	1,677	334	0.10	0.16	0.03
STAT307	180	35	0.23	0.21	<0.01
STAT311	140	27	0.00	0.19	0.49
STAT312	172	19	NA		
STAT315	61	7			

Notes:

(i) The small sample sizes and discrepancy in group sizes make the discovery of a significant effect difficult. Please interpret results with extreme caution and note the small sample sizes contribute to lack of significant results.

(ii) Students with course grades of I, S, or W were excluded from analyses.

(iii) Significant differences were not tested if the course/group of courses had less than 20 tutoring participants were not tested for significance.



4. Research Question: Among tutoring participants, does participation frequency in the TILT tutoring program predict a higher course grade after controlling for academic preparation (CCHE Index)?

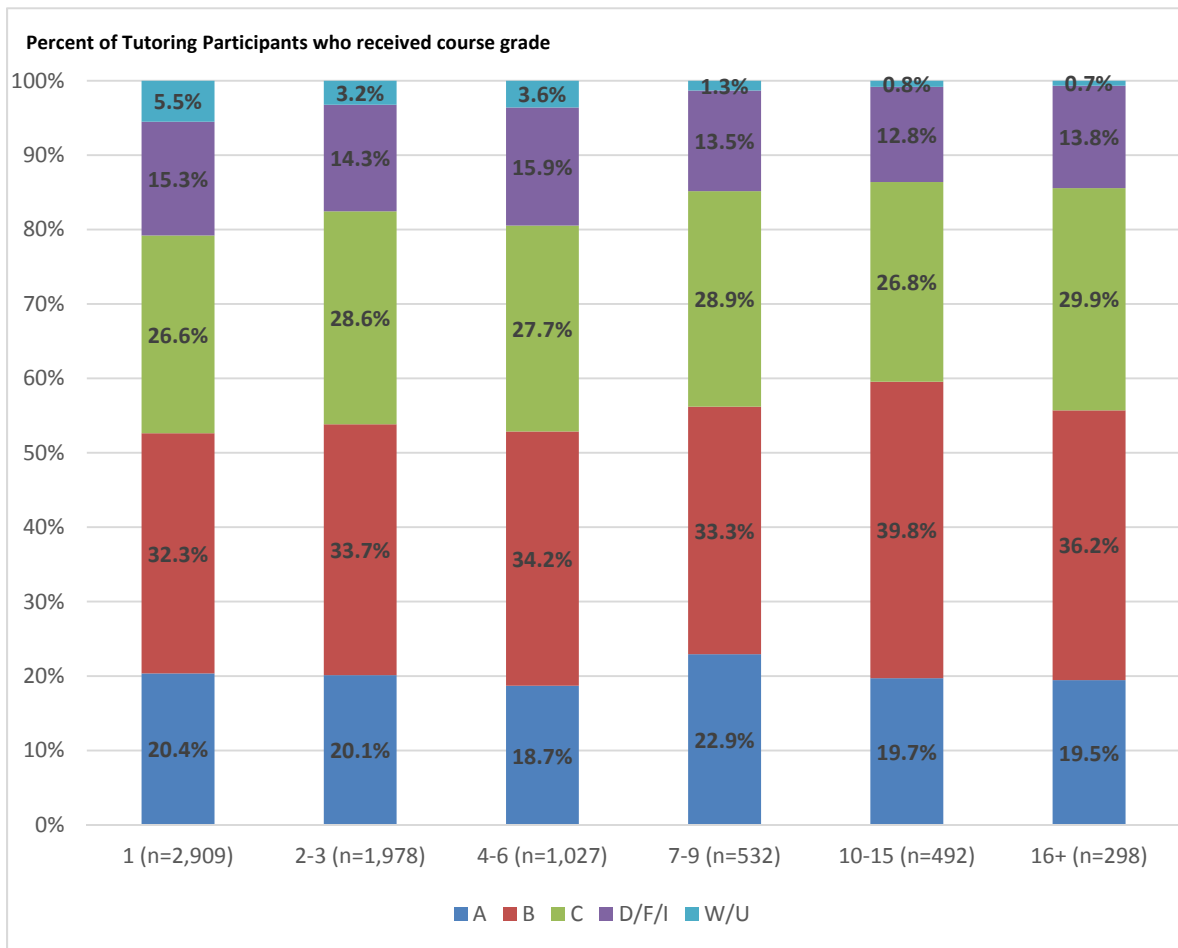
For the 2015-2017 academic years, the number of tutoring visits positively and significantly impacted course grade after controlling for a student's CCHE Index among tutoring participants ($p = .002$). However, when looking at this by academic year, this was only true for AY16-17 ($p = .01$) and there was no significant relationship between number of visits and course grade after controlling for index for AY15-16 ($p = .11$). On average, students attended tutoring for a course 4.01 times. The number of times students attended tutoring in AY16-17 (mean = 3.87) was significantly lower than in AY15-16 (mean = 4.17 times) ($p = .01$, $d = .06$).

Among the tutoring participants, 23% of students received an A in their course if they attended tutoring for their course 7-9 times. Sixty percent of students received an A or B in their course if they attended tutoring 10-15 times, while less than 54% of students who attended tutoring six times or less received an A or B. (Figure 2). With an average of 7.57 visits, MATH 155 had the highest number of visits per student (AY15=8.41, AY16=6.67). This was also the course with the highest number of visits in AY14-15 (mean = 10.02 times). Also notable, BZ 350, PH 121, PH 122, CHEM 245, and CHEM 113 all had an average number of visits per course higher than 5 (see Table 3).

Looking at the 2015-2017 academic years, the number of tutoring visits significantly, and positively, impacted course grade at the individual course level above and beyond index score for BZ 350, CHEM 111, CHEM 245, CHEM 341, LIFE102, MATH 155, and PH 142. When examining courses in aggregate by field, controlling for index, frequency of tutoring visits positively impacted course grades in Biology, Chemistry, and Physics courses. However, frequency of tutoring visits was not significantly related to course grade for BMS, ECON, or STAT courses after controlling for students' index scores.



Figure 3. Course grade by number of tutoring visits for AY 2015-2017



**Table 3.** AY 2015-2017: Linear regression results: Predicting final grades of tutoring participants based on number of tutoring visits after controlling for CCHE index

Course (AY15-17)	# Tutoring Participants	Average Grade Points	Avg. Grade Points Std. Dev.	Avg. # of Visits	Avg. # of Visits: Std. Deviation	Max # of Visits in a Term	Adj. R ²	B	p
ANEQ305	20	1.65	1.39	2.45	1.64	6	0.13	0.39	0.09
BC 351	57	2.70	0.97	1.77	1.23	5	-0.26	0.10	0.39
BMS	173	2.32	1.10	3.93	4.74	27	0.12	0.03	0.06
BMS 300	127	2.27	1.14	4.06	5.12	27	0.13	0.03	0.12
BMS 301	46	2.47	0.99	3.57	3.53	20	0.03	0.04	0.32
BZ 350	156	2.67	1.01	5.71	5.24	25	0.12	0.04	0.04
CHEM	1,825	2.39	1.06	4.12	5.27	45	0.10	0.02	<.01
CHEM103	82	2.63	0.69	3.23	3.90	24	0.14	0.03	0.09
CHEM107	75	2.65	0.90	2.77	3.31	17	-0.02	0.01	0.92
CHEM111	516	2.33	1.01	3.36	4.62	41	0.21	0.03	0.01
CHEM113	404	2.21	1.08	5.00	6.78	45	0.18	0.02	0.07
CHEM245	272	2.50	1.02	5.10	5.41	26	0.09	0.03	0.01
CHEM341	256	2.49	1.08	3.70	4.06	27	0.09	0.06	<.01
CHEM343	220	2.42	1.29	4.36	5.16	35	0.11	0.02	0.18
ECON	235	2.75	0.84	2.14	1.88	9	0.14	0.05	0.07
ECON202	135	2.67	0.85	1.91	1.54	10	0.18	0.03	0.58
ECON204	100	2.86	0.82	2.46	2.22	10	0.07	0.06	0.10
LIFE	489	2.45	1.05	2.64	3.36	29	0.19	0.05	<.01
LIFE102	392	2.47	1.08	2.82	3.63	29	0.23	0.05	<.01
LIFE103	85	2.30	0.93	1.86	1.68	10	0.09	0.10	0.12
LIFE210	12	2.91	0.94	2.50	2.07	7	NA		
LSPA	9	2.81	0.56	1.56	0.73	3	NA		
LSPA105	2	2.67	0.94	1.00	0.00	1	NA		
LSPA107	4	2.83	0.64	1.50	0.58	2			
LSPA201	2	2.67	0.00	2.00	1.41	3			
LSPA300	1	3.33		2.00		2			

**Table 3 cont.** AY 2015-2017: Linear regression results: Predicting final grades of tutoring participants based on number of tutoring visits after controlling for CCHE index.

Course (AY15-17)	# Tutoring Participants	Average Grade Points	Avg. Grade Points Std. Dev.	Avg. # of Visits	Avg. # of Visits: Std. Deviation	Max # of Visits in a Term	Adj. R ²	B	p
MATH	2,255	2.51	1.21	4.03	5.27	42	0.04	-0.01	0.10
MATH101	270	3.01	1.06	2.02	1.35	8	0.11	-0.01	0.89
MATH117	84	2.45	.75	2.01	2.62	20	0.14	.02	0.79
MATH118	61	2.98	.59	1.90	2.35	16	-0.01	-0.04	0.71
MATH124	14	2.85	.13	2.93	3.89	12	NA		
MATH125	38	2.68	.34	1.37	0.67	3	0.08	-0.13	0.8
MATH126	9	1.14	.7	1.22	0.44	2	NA		
MATH141	466	2.55	1.21	3.45	4.14	31	0.04	0.01	0.36
MATH155	502	2.29	1.25	7.57	7.67	42	0.09	0.02	0.03
MATH160	235	2.02	1.20	3.89	4.71	39	0.15	-0.01	0.55
MATH161	225	2.61	1.10	2.92	3.47	29	0.07	-0.02	0.25
MATH255	34	2.61	1.03	2.91	3.32	19	0.14	-0.07	0.21
MATH261	110	2.76	0.99	3.32	4.61	27	0.02	0.02	0.43
MATH340	117	2.24	1.21	3.42	4.72	31	0.00	0.03	0.25
MATH369	90	2.67	1.18	3.40	3.82	23	-0.02	-0.01	0.84
PH	1,166	2.78	0.95	5.04	5.47	44	0.11	0.02	<.01
PH 121	511	2.81	0.92	5.34	5.69	32	0.20	0.01	0.14
PH 122	196	3.16	0.76	5.66	5.37	25	0.07	0.02	0.14
PH 141	295	2.55	1.09	4.47	4.73	27	0.08	0.00	1.00
PH 142	164	2.64	0.84	4.40	6.00	44	0.09	0.03	0.01
STAT	851	2.77	0.98	3.52	3.38	21	0.10	0.01	0.59
STAT201	234	2.80	0.93	2.73	2.75	21	0.10	0.03	0.18
STAT204	195	2.65	0.99	2.60	2.43	13	0.13	0.02	0.61
STAT301	334	2.81	1.00	4.55	3.97	20	0.11	0.00	0.94
STAT307	35	3.17	0.87	4.03	3.71	12	0.08	-0.04	0.32
STAT311	27	2.72	0.91	3.74	2.90	14	0.10	-0.12	0.22
STAT312	19	2.53	1.03	4.16	2.67	10	NA		
STAT315	7	2.28	1.37	1.29	0.49	2	NA		
Total	7,236	2.57	1.08	4.01	4.94	45	0.07	0.01	<.01

Notes:

(i) The small sample sizes and discrepancy in group sizes make the discovery of a significant effect difficult. Please interpret results with extreme caution and note the small sample sizes contribute to lack of significant results.

(ii) Students with course grades of I, S, or W were excluded from analyses.

(iii) Significant differences were not tested if the course/group of courses had less than 20 tutoring participants were not tested for significance.



Conclusion

Overall, there is some evidence that tutoring participation has a positive association on student's course grade for specific courses and course fields. Further, frequency of visits emerged as a significant variable among certain courses. This finding could be used to encourage students to attend tutoring more than once in order to reap the benefit on their course grade. The tutoring program is serving females and students from an underrepresented race/ethnicity well, but the program could target first generation and certain majors more so.



Appendix

Table 4. Gender proportions for tutoring program participants and non-tutoring program participants by academic year.

Gender		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Female	AY15-16	1,362	56.8%	5,752	49.4%
	AY16-17	1,812	61.0%	5,750	49.2%
Male	AY15-16	1,036	43.2%	5,891	50.6%
	AY16-17	1,157	39.0%	5,931	50.8%

Table 5. Student characteristic proportions for tutoring program participants and non-tutoring program participants by academic year.

Student Characteristics		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
First Generation Students	AY15-16	611	25.6%	2,910	25.2%
	AY16-17	744	25.1%	2,905	25.2%
CO Residents	AY15-16	1,746	72.8%	8,273	71.1%
	AY16-17	2,076	69.9%	8,170	71.1%
STEM Majors	AY15-16	1,425	59.4%	5,383	46.2%
	AY16-17	1,649	55.5%	5,626	46.2%

Table 6. Student level proportions for tutoring program participants and non-tutoring program participants by academic year.

Student level		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Freshman	AY15-16	685	28.6%	3,703	31.8%
	AY16-17	870	29.3%	3,725	31.9%
Sophomore	AY15-16	793	33.1%	3,310	28.4%
	AY16-17	968	32.6%	3,359	28.8%
Junior	AY15-16	549	22.9%	2,534	21.8%
	AY16-17	648	21.8%	2,476	21.2%
Senior	AY15-16	362	15.1%	1,986	17.1%
	AY16-17	473	15.9%	2,000	17.1%



Table 7. Ethnicity and Minority status proportions for tutoring program participants and non-tutoring program participants by academic year.

Ethnicity/Minority Status		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Minority Student	AY15-16	539	22.5%	2,199	18.9%
	AY16-17	732	24.7%	2,401	20.6%
Asian	AY15-16	81	3.4%	304	2.6%
	AY16-17	87	2.9%	336	2.9%
Black	AY15-16	73	3.0%	227	1.9%
	AY16-17	91	3.1%	252	2.2%
Hawaiian/PI	AY15-16	2	0.1%	20	0.2%
	AY16-17	5	0.2%	17	0.1%
Hispanic	AY15-16	297	12.4%	1,286	11.0%
	AY16-17	445	15.0%	1,350	11.6%
Multi-Racial	AY15-16	70	2.9%	290	2.5%
	AY16-17	89	3.0%	392	3.4%
Native Amer.	AY15-16	16	0.7%	72	0.6%
	AY16-17	15	0.5%	54	0.5%
White	AY15-16	1,694	70.6%	8,367	71.9%
	AY16-17	2,080	70.1%	8,396	71.9%
International	AY15-16	71	3.0%	638	5.5%
	AY16-17	89	3.0%	600	5.1%
No Response	AY15-16	94	3.9%	439	3.8%
	AY16-17	68	2.3%	284	2.4%



Table 8. College major proportions for tutoring program participants and non-tutoring program participants by academic year.

College and Year		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Agricultural Sciences	AY15-16	130	5.4%	798	6.9%
	AY16-17	185	6.2%	796	6.8%
Business	AY15-16	116	4.8%	798	6.9%
	AY16-17	161	5.4%	750	6.4%
Engineering	AY15-16	335	14.0%	1,387	11.9%
	AY16-17	296	10.0%	1,445	12.4%
Health & Human Sciences	AY15-16	478	19.9%	2,181	18.7%
	AY16-17	624	21.0%	2,133	18.3%
Intra-University	AY15-16	300	12.5%	1,885	16.2%
	AY16-17	331	11.1%	1,675	14.3%
Liberal Arts	AY15-16	84	3.5%	954	8.2%
	AY16-17	174	5.9%	956	8.2%
Natural Sciences	AY15-16	543	22.6%	2,429	20.9%
	AY16-17	742	25.0%	2,600	22.3%
Veterinary Med. & Biomed. Sci.	AY15-16	162	6.8%	481	4.1%
	AY16-17	231	7.8%	518	4.4%
Warner College of Natural Res.	AY15-16	250	10.4%	730	6.3%
	AY16-17	225	7.6%	808	6.9%