Efficacy of TILT Tutoring Program
AY 2014-2015

The Institute for Learning and Teaching (TILT) provided academic support via the tutoring program to 830 unique students (1,027 cases of students participating in tutoring for distinctive courses) for twenty-five lower-level undergraduate courses in the 2014-15 academic year.[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.

Results Overview: Overall, tutoring participants had a higher course grade than non-tutoring participants when controlling for index (i.e. isolating the impact tutoring participation has on course grade). The two groups did not have statistically different course grades when not accounting for index score (non-tutoring participants had significantly higher index scores than tutoring participants). Several significant results emerged when examining the data by individual courses. Specifically, tutoring had a significant positive impact on course grades for ECON, PH, and MATH courses. Participation in the tutoring program appeared to be more important than number of visits as there was little evidence that frequent tutoring visits impacted a student's course grade compared to students who did not attend tutoring as frequently; however, the minimum requirement of three visits to be included in the study and the small sample size makes identifying significant effect sizes difficult.

Interpreting the Results: Please note the small group sizes for most individual courses make it difficult to extrapolate significant results and should be used with caution. Analyses conducted in aggregate will be more accurate than those analyses conducted at the individual course level. A small p-value indicates the results are less likely due to chance. Results yielding a p-value of .05 are considered statistically significant. Stated otherwise, smaller p-values indicate more significant results. Course grade and grade points can be interpreted as follows: A = 4.0, B = 3.0, C = 2.0, D = 1.0, F = 0.

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[1] There were 1,097 cases initially reported. Sixty-four cases were excluded when their specified tutoring course did not match a registered course for that term. Additionally, eight non-RI students were excluded. (Cases = 1,027; 830 unique students).

1. **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 2014-2015 academic year, students who participated in tutoring programs received similar course grades on average (mean = 2.53) when compared to non-tutoring participants (mean = 2.46) (p = .06). However, non-tutoring participants had significantly higher average index scores (mean = 116.96) than tutoring participants (mean = 114.38) (d = .22).
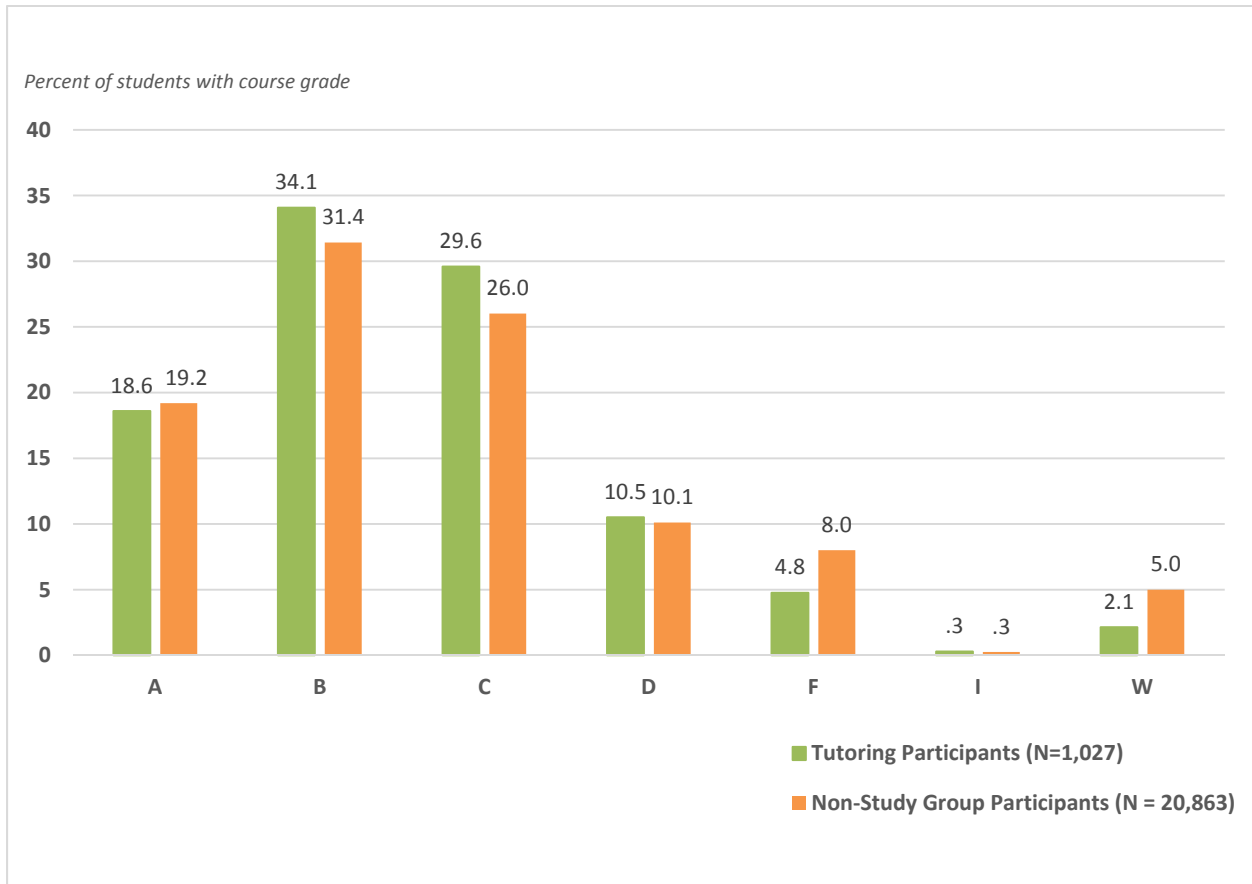
At the individual course level, non-tutoring participants had significantly higher index scores than tutoring participants for eleven of the twenty-five courses (mostly moderate to large effect sizes). Tutoring participants did not have significantly higher index scores than non-tutoring participants 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.

Although there was no overall significant difference in course grades, there were several significant differences when examining individual courses. Tutoring participants had significantly higher average course grades than non-tutoring participants in the following courses: ECON 202, ECON 204, MATH 155, and PH 142. On the other hand, non-tutoring participants had significantly higher course grades than tutoring participants in CHEM 111, MATH 160, and MATH 340 (note the large discrepancies in population) (see Table 1).

Interpreting the Results (Table 1): For a statistically significant result (p < .05), 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.

Figure 1. Course Grade by Tutoring Participation[2]

Percent of students with course grade

Legend:
- Tutoring Participants (N=1,027)
- Non-Study Group Participants (N = 20,863)

Grade	Tutoring Participants	Non-Study Group Participants
A	18.6	19.2
B	34.1	31.4
C	29.6	26.0
D	10.5	10.1
F	4.8	8.0
I	.3	.3
W	2.1	5.0

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[2] Course grades were collapsed into whole grades for summary purposes. For example, course grades of B+ and B- were categorized as 'B'.

Table 1. Academic Year 2014-15: Average course grade and CCHE index across tutoring program participant status and course.

Course	Tutoring Participants			Non-Tutoring Participants			d	
	#	Average Course Grade	Average CCHE Index	#	Average Course Grade	Average CCHE Index		
BMS 300	14	2.29	105.77	1,151	2.36	116.04	**0.87**	
BZ 350	53	2.71	117.96	268	2.44	119.35		
CHEM103*	9	2.26	104.00	192	2.25	109.40		
CHEM107*	6	2.06	107.00	349	2.30	112.10		
CHEM111	44	1.93	112.61	1,754	2.21	118.11	**0.29**	**0.48**
CHEM113	49	2.27	112.27	1,212	2.30	119.44	**0.64**	
CHEM245	53	2.19	112.34	517	2.28	117.80	**0.43**	
CHEM341	39	2.25	116.06	556	2.33	121.82	**0.55**	
CHEM343	24	2.29	120.00	450	2.50	124.17		
ECON202	18	3.06	109.20	1,834	2.66	114.02	**0.44**	
ECON204	16	3.10	109.30	1,271	2.53	113.36	**0.64**	
LIFE102	41	2.72	109.74	2,008	2.46	115.27	**0.50**	
MATH141	69	2.14	107.13	1,109	2.40	110.46	**0.32**	
MATH155	128	2.63	114.66	509	2.29	115.62	**0.28**	
MATH160	46	1.70	110.91	649	2.20	117.28	**0.42**	**0.61**
MATH161	41	2.46	112.14	686	2.51	120.65	**0.72**	
MATH261	33	2.46	120.79	652	2.04	123.02		
MATH340	9	1.67	116.33	556	2.49	123.64	**0.76**	**0.99**
MATH369**	4	1.58	117.67	136	2.49	120.69		
PH 121	111	2.78	116.90	605	2.69	118.57		
PH 122	48	3.42	122.05	459	3.20	121.37		
PH 141	60	2.50	117.07	642	2.34	120.81	**0.36**	
PH 142	46	3.15	121.89	480	2.77	123.51	**0.47**	
STAT201	16	2.90	107.64	752	2.69	110.05		
STAT301	25	2.96	111.95	971	2.91	116.96		
Total	1,002	2.53	114.38	19,768	2.46	116.96	**.22**	

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) **= Fall 2014 semester only; ** = Spring 2015 semester only*
(iii) *Students with course grades of I or W were excluded from all grade point analyses.*

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

- Noting the statistically significant differences between participants' index scores, 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, participation in the tutoring program significantly predicted a higher course grade compared to those students who did not participate in the tutoring program when controlling for the impact of index (average of a .19 grade point increase).
    - Students who participated in the tutoring program for ECON, MATH, and PH courses (categorized in aggregate) had significantly ($p < .05$) higher course grades (average increase of .58, .15, and .33 grade points respectively) compared to those students in the same courses who did not participate in course tutoring.
    - At the individual course level, tutoring participation for ECON 202, ECON 204, LIFE 102, MATH 155, MATH 161, MATH 261, PH 121, and PH 142 predicted significantly higher course grades than non-tutoring participants after controlling for index. Note, tutoring participation in MATH 160 actually had a significant negative impact on course grade.
- Due to the large group discrepancies and small number of tutoring participants, using a more suggestive p-value of .10 may provide further insight into the programs ($p < .10$). This less stringent standard would suggest tutoring programs also had an impact on BZ 350, Chemistry courses (particularly CHEM 103 and CHEM 113), MATH 369, PH 122, PH 141, and STAT 201 and 301 when combined in aggregate. Using a p-value of .10 would suggest an overall positive impact for well over half of the courses when controlling for academic index (see Table 2).

Interpreting the Results (Tables 2):
- 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 departments (e.g. three chemistry courses were combined and reported in aggregate in addition to reported individually).
- 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.
- 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.
- A bolded *p* value indicates tutoring participation is a statistically significant predictor of course grade above and beyond index level at the *p* < .05 level.

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

Course	# Tutoring Participants	# Non-Tutoring Participants	Adj R^2	B	*p*
BMS 300	14	1,151	0.17	0.53	0.12
BZ 350	53	268	0.21	0.26	*0.08*
CHEM	224	5,030	0.16	0.13	*0.08*
CHEM103*	9	192	0.14	0.7	*0.09*
CHEM107*	6	349	0.15	-0.13	0.82
CHEM111	44	1,754	0.24	0.03	0.84
CHEM113	49	1,212	0.19	0.28	*0.05*
CHEM245	53	517	0.11	0.04	0.81
CHEM341	39	556	0.11	0.17	0.43
CHEM343	24	450	0.04	-0.11	0.67
ECON	34	3,105	0.16	0.58	**0.002**
ECON202	18	1,834	0.16	0.52	**0.04**
ECON204	16	1,271	0.16	0.67	**0.03**
LIFE102	41	2,008	0.25	0.58	**0.00**
MATH	330	4,297	0.08	0.15	**0.045**
MATH141	69	1,109	0.09	-0.08	0.64
MATH155	128	509	0.16	0.32	**0.01**
MATH160	46	649	0.16	-0.41	**0.04**
MATH161	41	686	0.11	0.55	**0.02**
MATH261	33	652	0.09	0.54	**0.02**
MATH340	9	556	0.1	-0.38	0.40
MATH369**	4	136	0.04	-1.3	*0.07*
PH	265	2,186	0.15	0.33	**0.001**
PH 121	111	605	0.23	0.27	**0.01**
PH 122	48	459	0.13	0.22	*0.07*
PH 141	60	642	0.13	0.31	*0.06*
PH 142	46	480	0.09	0.47	**0.001**
STAT	41	1,723	0.15	0.32	*0.06*
STAT201	16	752	0.14	0.28	0.27
STAT301	25	971	0.15	0.36	0.11
Total	1,002	19,768	0.13	0.19	**0.00**

Notes: (i) The small sample 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) *= Fall 2014 semester only; ** = Spring 2015 semester only
*(iii) Students with course grades of I or W were excluded from all grade point analyses.*

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

For the 2014-2015 academic year, the number of tutoring visits did not significantly impact course grade after controlling for a student's CCHE Index among tutoring participants. On average for the academic year, a student received tutoring 7.56 times. PH 142 and MATH 155 had the most frequent tutoring participation (46 and 128 students respectively) with the average participant attending a course's tutoring 10.21 and 10.02 times respectively. Additionally, there was a high average number of times students received tutoring for CHEM 107, CHEM 245, and MATH 160 (visited more than 9 times on average).

Number of tutoring visits only significantly, and positively, impacted course grade for one course, BZ 350. BZ 350 participants on average participated in tutoring 6.62 times and had an average grade increase of .10 points for each additional tutor session. Using a p-value of .10, number of visits for tutoring in MATH 161 would also positively impact course grade (.05 points for each additional tutor session) (p=.07) (see Table 3).

Figure 2. Course grade by number of tutoring visits
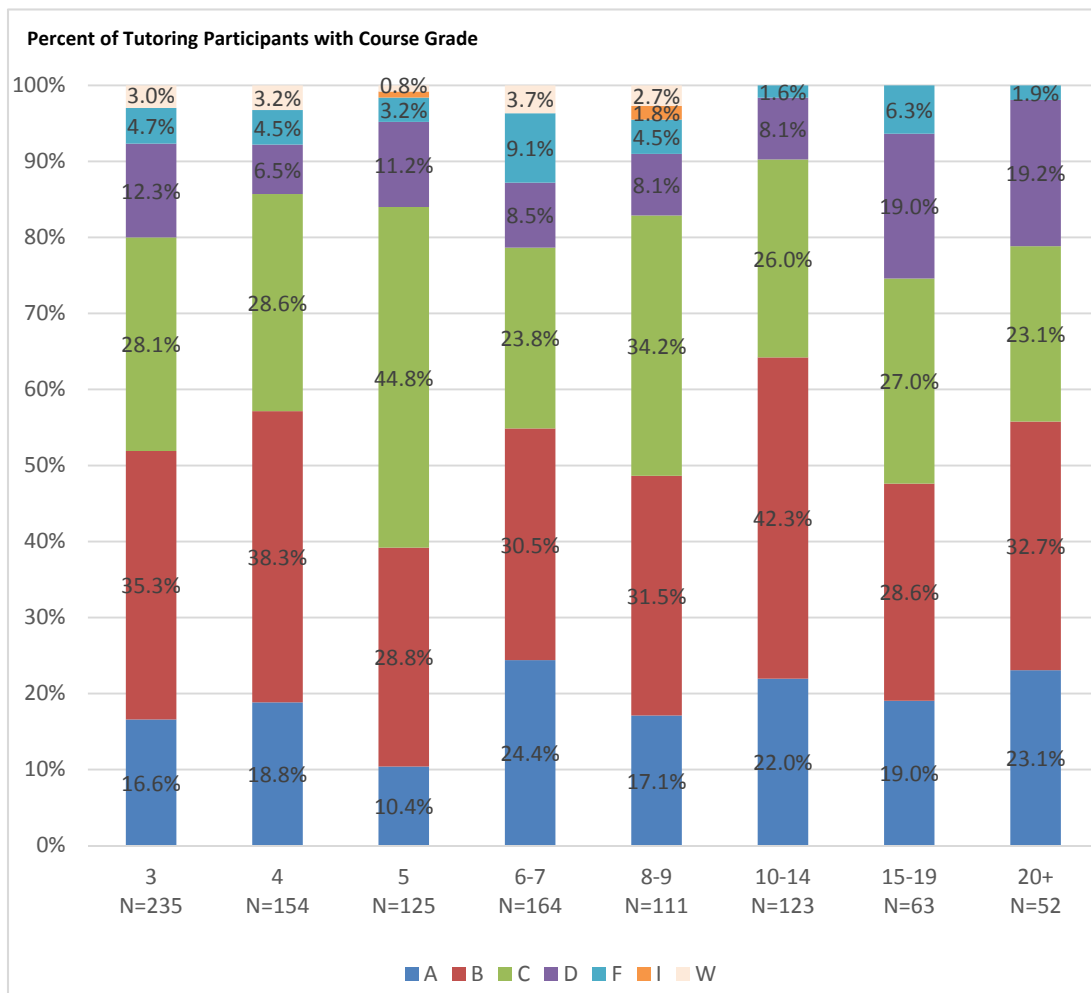
Table 3. AY 2014-2015: Linear regression results: Predicting final grades of tutoring participants based on number of tutoring visits after controlling for CCHE index.

Course	# Tutoring Participants	Average Grade Points	Avg. Grade Points Std. Dev.	Avg. # of Visits	Avg # of Visits: Std. Deviation	Min # Visits	Max # Visits	Adj R²	B	p
BMS 300	14	2.29	1.14	6.93	4.53	3	18			
BZ 350	53	2.71	0.86	6.62	2.60	3	14	0.18	0.10	**0.03**
CHEM	224	2.18	1.00	7.20	5.73	3	43	0.07	0.01	0.35
CHEM103*	9	2.26	0.98	4.33	1.58	3	7			
CHEM107*	6	2.06	0.93	9.83	9.43	3	27			
CHEM111	44	1.93	0.86	6.02	4.65	3	23	0.13	0.00	0.93
CHEM113	49	2.27	0.91	8.08	7.74	3	43	0.20	-0.01	0.39
CHEM245	53	2.19	1.13	9.46	5.43	3	25	0.02	0.05	0.13
CHEM341	39	2.25	1.23	5.44	3.55	3	22	0.06	0.04	0.46
CHEM343	24	2.29	0.81	5.88	4.23	3	20	0.07	0.06	0.19
ECON	34	3.08	0.70	6.50	4.37	3	17	0.06	0.06	0.14
ECON202	18	3.06	0.73	4.94	2.86	3	14	-0.10	0.01	0.89
ECON204	16	3.10	0.69	8.25	5.16	3	17	0.16	0.09	0.11
LIFE102	41	2.72	0.84	5.09	3.06	3	16	0.29	0.05	0.10
MATH	330	2.32	1.16	8.19	6.38	3	38	0.12	0.00	0.91
MATH141	69	2.14	1.10	7.09	6.29	3	38	0.10	0.05	*0.07*
MATH155	128	2.63	1.07	10.02	7.06	3	36	0.18	-0.01	0.61
MATH160	46	1.70	1.19	9.16	7.00	3	30	0.16	0.02	0.52
MATH161	41	2.46	1.27	6.02	2.89	3	14	0.05	-0.03	0.71
MATH261	33	2.46	0.98	5.33	4.14	3	21	0.02	-0.06	0.13
MATH340	9	1.67	1.00	6.10	4.61	3	18			
MATH369**	4	1.58	1.83	7.75	2.06	5	10			
PH	265	2.90	0.92	8.08	5.99	3	49	0.21	0.01	0.14
PH 121	111	2.78	0.90	7.34	4.45	3	24	0.21	0.02	0.37
PH 122	48	3.42	0.64	6.81	3.76	3	19	0.19	0.00	0.87
PH 141	60	2.50	1.05	8.80	6.96	3	33	0.22	0.02	0.34
PH 142	46	3.15	0.72	10.21	8.65	3	49	-0.02	0.01	0.43
STAT	41	2.93	0.75	5.83	2.91	3	13	0.19	0.02	0.71
STAT201	16	2.90	0.75	4.69	2.36	3	11	-0.02	-0.01	0.89
STAT301	25	2.96	0.77	6.56	3.04	3	13	0.24	0.03	0.58
Total	1,002	2.53	1.06	7.56	5.74	3	49	0.14	0.01	0.16

 Notes
(i): Regression analysis was not conducted for any tutoring course with less than 15 participants.
(ii)* = Fall semester only; ** = Spring semester only
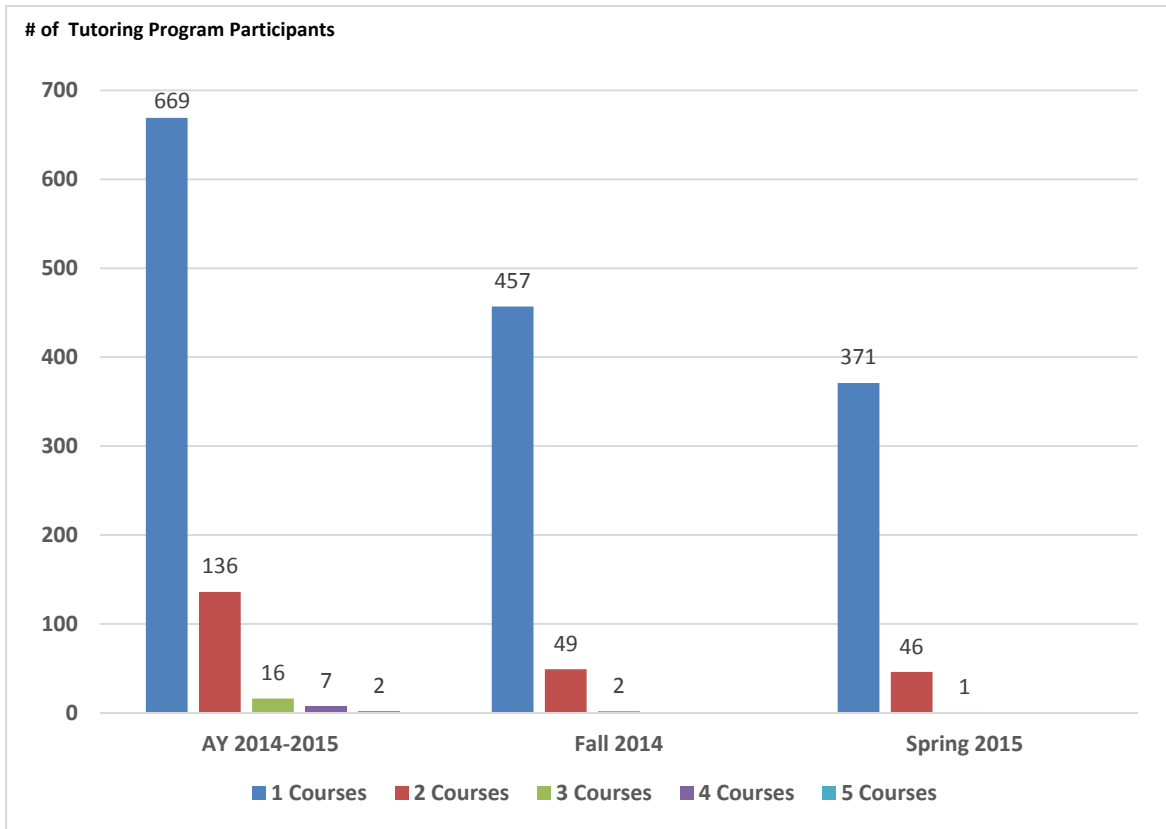*(iii) Students with course grades of I or W were excluded from all grade point analyses.*

4. **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, there were 1,027 students who participated in TILT's tutoring program for their individual courses. However, there were 830 unique tutoring participants since numerous students attended tutoring for multiple courses (see Figure 3).

- Compared to non-tutoring participants enrolled in the same courses for the respective term during academic year 2014-2015, the demographic characteristics indicate women disproportionately attended tutoring (60% of tutoring participants were women vs. 49% of non-tutoring participants) while men were underrepresented (40% vs. 51% respectively). Women particularly were well-represented in the tutoring program in the FA14 term (64% vs. 50% of non-tutoring participants) (see Table 4).

- STEM majors (66% of tutoring participants vs. 52% of non-tutoring participants) and minority students (25% of tutoring participants vs. 18% of non-tutoring participants) were well represented in the tutoring program; however, there were lower proportions of international students (1.4%) participating in the tutoring program compared to non-participants (4.8%). There were roughly similar percentages of first generation students who participated in tutoring programs (26%) compared to non-participants (24%) (see Tables 5 and 7).

- Over a third (35%) of tutoring participants were sophomores (33% of non-tutoring participants). Seniors were disproportionately represented (24% of tutoring participants and 15% of non-participants), while freshmen were disproportionately underrepresented (24% of tutoring participants, yet 31% of non-participants) (see Table 6).

- Almost a third of students who participated in the tutoring program were from Natural Sciences (32%) despite comprising only a quarter (24%) of the non-tutoring participants. Students with majors in Agricultural Sciences, Business, and Liberal Arts each comprised less than 5% of the tutoring program participants (see Table 8).

Figure 3. Number of tutoring participants receiving services for multiple courses

# of Tutoring Program Participants

AY 2014-2015: 1 Courses 669, 2 Courses 136, 3 Courses 16, 4 Courses 7, 5 Courses 2

Fall 2014: 1 Courses 457, 2 Courses 49, 3 Courses 2

Spring 2015: 1 Courses 371, 2 Courses 46, 3 Courses 1

Legend: 1 Courses · 2 Courses · 3 Courses · 4 Courses · 5 Courses

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

Gender		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Female	AY14-15	498	60.0%	5,362	49.4%
	FA14	327	64.4%	4,043	49.5%
	SP15	235	56.2%	3,502	48.5%
Male	AY14-15	332	40.0%	5,484	50.6%
	FA14	181	35.6%	4,129	50.5%
	SP15	183	43.8%	3,719	51.5%

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

Student Characteristics		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
First Generation Students	AY14-15	218	26.3%	2,626	24.2%
	FA14	134	26.4%	1,939	23.7%
	SP15	108	25.8%	1,676	23.2%
CO Residents	AY14-15	617	74.3%	8,050	74.2%
	FA14	392	77.2%	6,043	73.9%
	SP15	298	71.3%	5,313	73.6%
STEM Majors	AY14-15	544	65.5%	5,677	52.3%
	FA14	332	65.4%	4,561	55.8%
	SP15	287	68.7%	4,034	55.9%

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

Student level		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Freshman	AY14-15	198	23.9%	3,360	31.0%
	FA14	122	24%	2,544	31.1%
	SP15	86	20.6%	1,861	25.0%
Sophomore	AY14-15	292	35.2%	3,521	32.5%
	FA14	180	35.4%	2,827	34.6%
	SP15	146	34.9%	2,431	33.7%
Junior	AY14-15	197	23.7%	2,248	20.7%
	FA14	126	24.8%	1,688	20.7%
	SP15	99	23.7%	1,687	23.4%
Senior	AY14-15	197	23.7%	1,642	15.1%
	FA14	180	35.4%	1,059	13.0%
	SP15	86	20.6%	1,199	16.6%
Graduate	AY14-15	1	.1%	75	.7%
	FA14	0	0%	54	.7%
	SP15	1	.2%	43	.6%

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

Ethnicity/Minority Status and Year		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Minority Student	AY14-15	204	24.6%	1,963	18.1%
	FA14	126	24.8%	1,487	18.2%
	SP15	102	24.4%	1,291	17.9%
Asian	AY14-15	28	3.4%	273	2.5%
	FA14	18	3.5%	212	2.6%
	SP15	14	3.3%	186	2.6%
Black	AY14-15	35	4.2%	200	1.8%
	FA14	17	3.3%	150	1.8%
	SP15	23	5.5%	121	1.7%
Hawaiian/PI	AY14-15	1	.1%	8	.1%
	FA14	1	.2%	6	.1%
	SP15	0	0%	6	.1%
Hispanic	AY14-15	110	13.3%	1,149	10.6%
	FA14	73	14.4%	872	10.7%
	SP15	50	12.0%	761	10.5%
Multi-Racial	AY14-15	25	3.0%	268	2.5%
	FA14	14	2.8%	206	2.5%
	SP15	13	3.1%	166	2.3%
Native Amer.	AY14-15	5	.6%	65	.6%
	FA14	3	.6%	41	.5%
	SP15	2	.5%	51	.7%
White	AY14-15	562	67.7%	8,000	73.8%
	FA14	351	69.1%	6,019	73.7%
	SP15	276	66.0%	5,340	74.0%
International	AY14-15	27	3.3%	522	4.8%
	FA14	11	2.2%	371	4.5%
	SP15	19	4.5%	384	5.3%
No Response	AY14-15	37	4.5%	361	3.3%
	FA14	20	3.9%	295	3.6%
	SP15	21	5%	206	2.9%

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

College and Year		# Tutoring Participants	% of Tutoring Participants	# Non-Tutoring Participants	% of Non-Tutoring Participants
Agricultural Sciences	AY14-15	31	3.7%	717	6.6%
	FA14	15	3.0%	560	6.9%
	SP15	17	4.1%	382	5.3%
Business	AY14-15	16	1.9%	612	5.6%
	FA14	9	1.8%	449	5.5%
	SP15	11	2.6%	414	5.7%
Engineering	AY14-15	105	12.7%	1,485	13.7%
	FA14	71	14.0%	1,274	15.6%
	SP15	47	11.2%	1,118	15.5%
Health & Human Sciences	AY14-15	139	16.7%	2,074	19.1%
	FA14	81	15.9%	1,495	18.3%
	SP15	67	16.0%	1,309	18.1%
Intra-University	AY14-15	112	13.5%	1,501	13.8%
	FA14	73	14.4%	1,031	12.6%
	SP15	44	10.5%	945	13.1%
Liberal Arts	AY14-15	19	2.3%	657	6.1%
	FA14	13	2.6%	428	5.2%
	SP15	8	1.9%	388	5.4%
Natural Sciences	AY14-15	262	31.6%	2,555	23.6%
	FA14	158	31.1%	1,966	24.1%
	SP15	136	32.5%	1,756	24.3%
Veterinary Med. & Biomed. Sci.	AY14-15	58	7%	495	4.6%
	FA14	43	8.5%	435	5.3%
	SP15	33	7.9%	451	6.2%
Warner College of Natural Res.	AY14-15	88	10.6%	750	6.9%
	FA14	45	8.9%	534	6.5%
	SP15	55	13.2%	458	6.3%