Project TRUE Research Report

Results from the 2015 Cohort

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Executive Summary

Project TRUE seeks to increase the interest of high school students in pursuing science, technology, engineering and mathematics majors by increasing participants' exposure to urban ecology research conducted with college mentors. The Lifelong Learning Group is conducting research that explores the program's longer-term influence on academic and career choices. More specifically, the research addresses the question:

How do the four key elements of youth development in Project TRUE contribute to pursuit of advanced STEM study and career path in the short- and medium-term?

Sub-questions addressed include:

1. How do the four key program elements (jointly or severally) contribute to short-term changes in intent to pursue STEM study and/or intended career path?
2. How do the four key program elements contribute to sustained changes in pursuit of STEM study and intent to pursue STEM careers?
3. To what degree do other, non-program factors known to be influencers (i.e., parental support; in-school exposure; etc.) play into STEM study/career choices – either limiting or enhancing the contribution of program factors?

This report presents baseline findings (relating to questions 1 and 3) established in the project's first year. Data sources include an on line post-program questionnaire completed by the 44 first-year participants; pre-program enrollment applications; and project records. The post-program questionnaire included psychometrically sound scales to measure perceived mentorship quality; motivational quality of participation (as measured by basic psychological need satisfaction and frustration); TRUE influence on career choice; outside influences on choices and decision making; Science Interest; and perceived changes in positive youth development (including science and research skills; identity; leadership; community and environment; and habits).

Results Addressing Research Question #1:

How do the four key program elements contribute (jointly or severally) to short-term changes in intent to pursue STEM study and/or intended career path?

Summary of what we learned (illustrated in Figure 1)

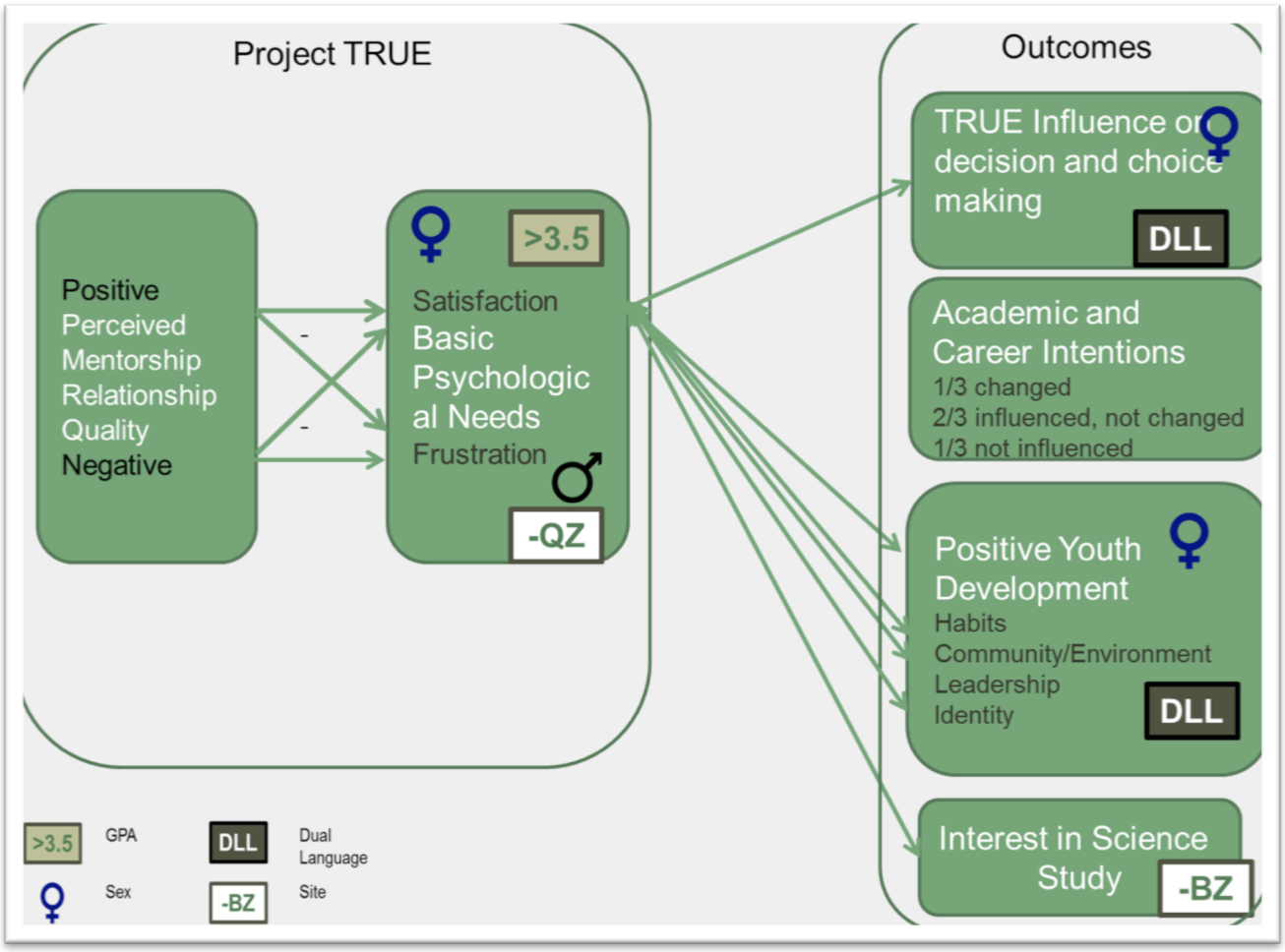
- Approximately one third of the 44 participants reported a Project TRUE-related change in their academic or career intentions. An additional third reported Project TRUE influence either in focus, confidence, or new interest.

- Need satisfaction differed by sex such that girls' needs for sense of competence, sense of relatedness, and sense of autonomy were more satisfied and less frustrated than boys.

- Need frustration was lowest at the Queen Zoo and significantly lower than the Central Park Zoo where the? need frustration was highest.

- There were high correlations between students' perception of the Mentorship and both Basic Psychological Need Frustration and Satisfaction. These relationships persisted after controlling for sex.
- Female participants perceived greater Project TRUE influence than male participants
- Females perceived themselves as gaining significantly more than males in all Positive Youth Development areas but habits.
- Dual language learners rated Project TRUE influence higher than the rest of the group
- The mean Science Interest was significantly lower at the Bronx Zoo.

Figure 1. Findings related to research question #1.

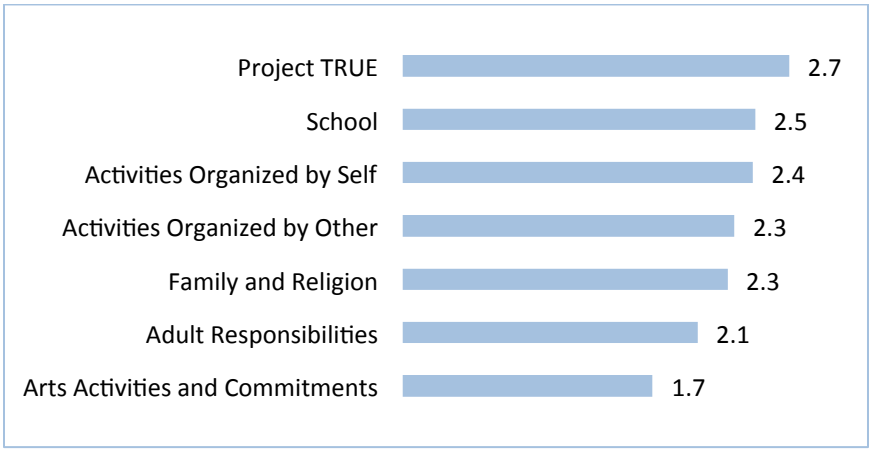


Results Addressing Research Question #3:

To what degree do other, non-program factors known to be influencers (i.e., parental support; in-school exposure; etc.) play into STEM study/career choices – either limiting or enhancing the contribution of program?

- Of all the external factors that might influence students' choices and decisions, at least for these students' final program day, Project TRUE ranked highest.
- Students' level of being influenced by self-organizing activities correlated with how much they experienced their Project TRUE involvement as affecting their positive development.

The ranking of external influences can be found in the figure below:



Conclusion

The findings summarized in this report serve three purposes: (1) they constitute baseline data for the five-year research planned; (2) They served as program feedback for the Project TRUE staff and leadership team and (3) they serve as documentation for exploring the nexus between the program's evaluation findings and these research findings.

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Introduction

Project TRUE utilizes a tiered mentorship learning model to increase the interest of high school students in pursuing science, technology, engineering and mathematics majors by increasing participants' exposure to urban ecology research conducted with college mentors. As part of the project, The Lifelong Learning Group is conducting research that explores the program's longer-term influence on participants' academic and career choices. More specifically, the research addresses the question:

> *How do the four key elements of youth development in Project TRUE contribute to pursuit of advanced STEM study and career path in the short- and medium-term?*

Sub-questions addressed include:

1. How do the four key program elements (jointly or severally) contribute to short-term changes in intent to pursue STEM study and/or intended career path?
2. How do the four key program elements contribute to sustained changes in pursuit of STEM study and intent to pursue STEM careers?
3. To what degree do other, non-program factors known to be influencers (i.e., parental support; in-school exposure; etc.) play into STEM study/career choices – either limiting or enhancing the contribution of program factors?

To answer these questions, this research builds upon the program's theoretical design to interweave four core principles for encouraging youth's long-term engagement in STEM:

1. Hands-on STEM experience;
2. Awareness of the utility of STEM learning in the world;
3. Exposure to a role model; and
4. Interaction with peers with shared STEM interest.

This report presents baseline findings established in the project's first year when the project took place in the context of mentorship teams at each of four New York City zoos. Each was staffed with a Ph.D. candidate researcher, a zoo instructor, three or four undergraduate field research leaders and between 10 and 12 high school students. Thus, each high school student was assigned (along with one to three others) to an undergraduate student, all working within a project designed and run by a Ph.D. candidate and a zoo educator.

Methods

Population

Forty-four students, two thirds of whom were female, completed the 2015 program. Of this group, one third were Black or African American; a quarter were Asian; and a quarter Hispanic. One person (2%) identified as white, non-Hispanic (For further detail, see Table 1). Nine students (22%) were dual language learners. Student-reported GPA scores averaged 3.5 and ranged from 2.7 to 4.0. Of the full group, 42% (19 students) reported grade point averages lower than 3.5.

Table 1. Description of the respondents/participants: race by ethnicity.

	Asian	Bengali	Filipino	Grenadian	Hispanic or Latino	Jamaican	Not Hispanic or Latino	Unknown	Total	
Asian	1	1					7	2	11	25%
Black or African American				1	2	1	9	2	15	34%
Hispanic or Latino					11				11	25%
Native Hawaiian or other Pacific Islander			1				2		3	7%
White/Hispanic					2				3	7%
White/Iranian/Hispanic					1				1	2%
White/Not Hispanic							1		1	2%

DATA Sources

An online questionnaire (see Appendix) completed by 2015 participants on the final day of their Project TRUE experience comprised the primary data source for the findings in this report. Additional sources were participant pre-program enrollment applications and project records. Together, these sources functioned to provide short-term outcome data (to be used as baseline time-series dependent variables in the longitudinal study), process measures (to be used as independent variables in the longitudinal study) and control variables. Each variable is listed in Table 2 along with its function, the instrument that produced it, and its data source.

Table 2. Cohort 2015 variables, scales that produce them, and data sources

Function	Variable Name	Instrument	Data Source
Short term Outcomes	Change in Project TRUE Influence	Extra-Program Influence Inventory items concerning Project TRUE and Project TRUE mentor .	Post-program questionnaire
	Change in Science Interest	Interest in Science Scale (17 items)[1]	
	Program Effect on Positive Youth Development (PYD)	Self-Reflection on PYD scales: Habits (4 items), Science and Research Interest (8 items), Leadership (7 items), community and environment (5 items), and Identity (9 items; Koke, Heimlich, Kessler, Ong, & Ancelet, 2007)[1]	
	Change in academic and career intentions: Self-perceived	Intention qualitative response items: current and retrospective.	
	Change in academic and career intentions: Observed	Intention qualitative response items: current	Program enrollment application; Post-program questionnaire

[1] Validity tested in year 1; documented in Heimlich & Wasserman (2015)

Variable Function	Variable Name	Instrument	Data Source
Program Experience (independent) variables: indicators	Motivational quality of the program experience	Basic Psychological Need Satisfaction (9 items) and Frustration (9 items) Scales; (Chen et al., 2014)	Post-program questionnaire
	Mentor Relationship Quality	Gauging the Effectiveness of Youth Mentoring questionnaire; (3 positive items and 14 negative; Rhodes, Reddy, Roffman, & Grossman, 2005)	
	Research Team and mentor		Program records
Control variables	Extra-Program Influences	Extra-Program Influence Inventory[1] (17 item inventory of important influences on an individual's schooling, career intentions, and interests)	
	Demographics	Sex, Self-reported GPA, Dual language, Outside influences	Program application
Baseline Data	Influences, academic intentions and science interest (see above) also function as baseline data for the longitudinal study		

The Influences Inventory consists of 19 items, two of which document the influence of PROJECT TRUE, and are considered outcomes (the remaining seventeen items function as control variables).

The Positive Youth Development scales were adapted from Koke, Heimlich, Kessler, Ong, & Ancelet (2007) and validated using factor confirmation and external validity and reliability measures. The resulting instrument included the following measures and items:

Scale validation

Three of the instruments described in Table 2 (Project TRUE Influences and Extra Program Influences; Science Interest; and Positive Youth Development,) were developed through a psychometric development process during 2015, described fully in Heimlich & Wasserman, 2015.

In the development phase, four instruments (*Influences*; *Mentor Experience*; *Positive Youth Development* [PYD]—with five sub scales; and *Interest in Science*) were created using scale construction methods for psychometric validation. The *Influences Inventory* and *Interest in Science Scale* required external validity for face, construct, and item measure purposes. These scales were developed using standard methods (for documentation, see Heimlich & Wasserman, 2015).

The final questionnaire consisted of these four scales with the addition of a psychometrically sound basic psychological needs satisfaction and frustration scale (Chen et al., 2014).

The population specific measures were run against the data from the 44 participants in the summer 2015 Project TRUE cohort. Table 3 compares the alpha from the scale construction with the alpha from the population for all scales and subscales, demonstrating that the scales held well for the population in this study.

Table 3. Comparison of development and applied scale reliabilities.

Scale	Alpha Development	Alpha Population
Influences	.755	.730
Mentor (negatives)	.840	.814
Mentor (with positives reversed scored)	.908	.844
PYD – Overall	.952	.899
PYD – Habits	.692	.812
PYD – Science & Research	.877	.844
PYD – Community and Environment	.846	.844
PYD – Leadership	.891	.865
Interest in science	.853	.834
Basic Psychological Need Satisfaction		.780
Basic Psychological Need Frustration		.817

Results Addressing Research Question #1:

How do the four key program elements contribute (jointly or severally) to short-term changes in intent to pursue STEM study and/or intended career path?

Summary of what we learned

1. Approximately a third of the 44 participants reported a Project TRUE-related change in their academic or career intentions. An additional quarter reported no fundamental change but some Project TRUE effect.

2. Need satisfaction differed by sex such that girls' needs for sense of competence, sense of relatedness, and sense of autonomy were more satisfied and less frustrated than boys.

3. There were high correlations between students' perception of the Mentorship and both Basic Psychological Need Frustration and Satisfaction. These relationships persisted after controlling for sex.

4. Female participants perceived greater Project TRUE influence than male participants

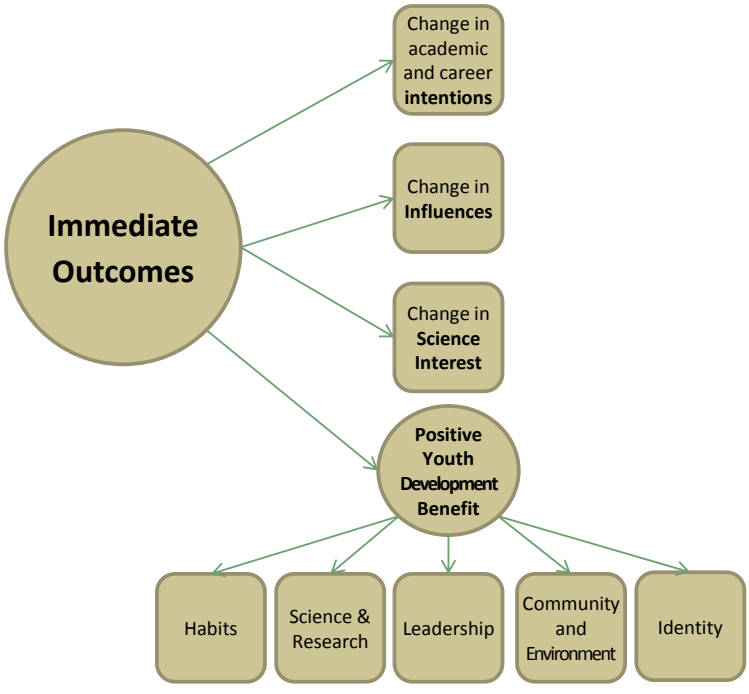
5. Females perceived themselves as gaining significantly more than males in all Positive Youth Development areas but habits.

6. Dual language learners rated Project TRUE influence higher than the rest of the group

7. The mean Science Interest was significantly lower at the Bronx Zoo.

Immediate Outcomes : changes in intent to pursue STEM study or intended career path.

The research design (Heimlich & Wasserman, 2015) operationalizes Immediate Outcomes as including four areas: (1) changes in intentions toward pursuing a career in science; (2) changes in influences; (3) changes in science interest and (4) perceptions of program effects on Positive Youth Development. Change analysis could take place this first year by comparing questionnaire results to information gathered from students' responses to questions required for their application to the program. The post-program perceptions will function as baseline data in future reports that will compare retrospective perceptions of program effect to these immediate post-program perspectives.



Change in Academic and Career Intentions

Determination of Change in Academic and Career intentions were drawn from coded thematic analysis of qualitative questions in both the post-program questionnaire and the pre-program application. Participants' **self-perception of change** derived from two short-essay response questions about their academic and career intentions: (1) *If [you are planning to attend college], at the beginning of the summer, before you participated in Project TRUE, what academic subjects did you think you might pursue in college?* And (2) *Now that you have participated in Project TRUE, have your interests changed at all? Now what academic subjects do you plan to pursue?* The second source, producing participants' **observed change**, was comparing participants' pre-program response to the program application question "*If you plan to attend college, have you thought about what you will major in? OR what your career path might be? Please explain*" to the post-program questionnaire response to the question, "*Right now, if you had to choose, what would your career be?*"

Perceived change: Of the 44 participants, 33% reported a change in their academic or career intentions (e.g., from ". . . prevet" to ". . . environmental policies along with wildlife/marine conservation") with an additional 17 (39%) reporting no fundamental change but a differing perspective (e.g "Have not changed at all but I feel more confident in pursuing biology in college"). Thematic analysis revealed that changes involved added or expanded interest; more options, more focus, deeper interest, and more confidence. Counts, examples and definitions where needed are presented in Table 4.

Table 4. Types and counts of perceived change in academic or career intentions.

Theme	Definition with Example	Count
No effect	Student reported "no change" or "haven't changed"	13
Added interest	Reference to or indication of expanding intentions, e.g. adding the word "technology" to the list of "before" subjects or "I still want to study pre-med and biology, but I also want to study ecology. . . . "	8
More Options	Reference to greater availability of considerations , e.g., change from "biology" to "zoology, animal-science, or pre-vet." Or "biology" to "science."	12
More Focus	e.g., change from "science --like medicine or physics" to "environmental science"	4
Deeper Interest	e.g., "I have a further interest in science and Project TRUE has contributed to that."	1
Deeper, Broader Understanding	e.g., ". . . Project TRUE did give me a deeper understanding; "my knowledge has broadened."	1
More Confidence	e.g., "[Project TRUE] has helped me realize that I can pursue any scientific subject without needing to worry too much about how my grades will determine my aptitude."	2
Other	e.g., "enjoy science	2
Missing		1
Grand Total		**44**

Observed Change (comparison of career interest at time of application to career interest at the end of the program). Thirty-three students (75%) demonstrated a change in their career intentions. These changes were further coded into the change types used to analyze Perceived Change. Sixteen students' responses (36%) were more focused, although this type of "focus," e.g,. "Engineering or Biology" to "Engineering," could have been a vestige of the desire to present a broader perspective when applying for a program. Of the eleven students (25%) who demonstrated no change; five of

these were committed to medical careers. Nine students (20%) demonstrated opening to more options; 6 (14% changed their interest) and 2 (5%) added an interest. These numbers summarize the Table 5 detail that presents the disciplines these students reported at enrollment and those they chose at the end.

Finally, students provided response to the question, "*For what reasons have you chosen the academic interests you listed above?*" Responses could be divided into themes of personal interest; help people; help animals; global problem solving; or job security. Of the eight comments that were Project TRUE explicit (e.g., *But now, after project true, I want to take time and study more on an ecology level and become one with nature*), 5 reflected personal interest and three global problem solving.

Table 5. Observed changes in career choice (from before to after program)

Career Choice at Time of Application	Total	No Change	Added Interest	Changed Interest	More Focus	More Options/ Less Focus	Post Program Career Choice
Undecided	**1**				**1**		Medicine
Biology	**5**	**1**		**1**	**3**		Biology; Criminology; Ecology; Forensic Science; Veterinary Medicine or Science
Biology, Psychology	**2**			**2**			Criminology; Ecology
Biology, Veterinary Medicine/Science	**1**				**1**		Environmental Science, Veterinary Medicine/Science
Biology, Space/Astronomy, Astronaut/Cosmonaut	**1**				**1**		Space/Astronomy
Chemistry	**1**					**1**	Undecided
Engineering	**4**	**2**			**2**		Biology; Engineering (2); Medicine, Biology
Engineering, Astronaut/Cosmonaut	**1**		**1**				Engineering, Astronaut/Cosmonaut
Engineering, Environmental Science	**1**	**1**					Engineering, Environmental Science
Engineering, Technology**, Environmental Science**	**1**				**1**		Engineering
Environmental Science	**3**	**1**		**1**	**1**		Ecology; Environmental Science; Nutrition
Mathematics, Psychology	**1**		**1**				Mathematics, Psychology, Sports
Medicine	**5**	**5**					Medicine (5)
Medicine, Biology	**4**	**1**			**1**	**2**	Medicine; Medicine, Biology (2); Medicine, Ecology
Medicine, Biology, Engineering	**1**					**1**	Space/Astronomy
Medicine, Psychology	**2**			**1**		**1**	Medicine; Engineering, Ecology
Medicine, Veterinary Medicine/Science	**3**					**3**	Zoology; Undecided; Medicine; Veterinary Medicine, Ecology
Technology	**1**			**1**			Ecology
Veterinary Medicine/Science	**2**				**1**	**1**	Veterinary Medicine/Science (2)
Engineering, Architecture	**1**				**1**		Engineering
Engineering, Technology, law, art, Chemistry	**1**				**1**		Technology
Engineering, Technology, Mathematics	**1**				**1**		Technology
Engineering, Biology	**1**				**1**		Medicine
Grand Total	**44**	**11**	**2**	**6**	**16**	**9**	

Change in Project-TRUE Influence

Two items of the influence inventory were used for understanding Project TRUE's short term influence on decision making. Students rated on a 3-point scale (1= not at all; 2= somewhat, and 3= a lot) the items, "My participation in Project TRUE" and "My Project TRUE mentor" as having "positively influenced your interests and decisions." In addition to functioning as short term outcome indicators, these results will also be used as baseline for future years as we measure durability (possibly through survival analysis) of PROJECT TRUE influence.

Of the 19 items in the inventory, students rated these two as having greatest influence (See section of this report that addresses evaluation questions #3). However**, female participants perceived greater Project TRUE influence than male participants** (Female $\bar{X}$ = 2.8, *s.d.*=.3; Male $\bar{X}$ = 2.4, *s.d.*=.4; t=3.0, df=18.2, p=.006). This difference existed in both the program and mentor response items, but was more prominent in the former (X^2=7.51, df=1, p = .006 *compared to mentor* X^2=6.07, df=1, p = .014). No participant rated either item as "not at all," but 8 of the 14 males (57%) rated both Project and Mentor influence as "somewhat" compared to five of the 30 females (20%) rating Program influence and six (17%) rating mentor influence as "somewhat."

Ratings also **significantly differed by groups based dual language learning**. Dual language learners rated Project TRUE influence higher ($\bar{X}$ =2.9, *s.d.*=.22) than the rest of the group for whom English was their first language ($\bar{X}$ =2.6, *s.d.*=.22; t=2.5, df=22.9, p=.021).

There were no differences based on GPA groups (above and below 3.5) or Research Team.

Change in Science Interest

To assess students' interest in science, students responded to the seventeen-item Interest in Science scale (Heimlich & Wasserman, 2015) developed for this study. Four subscales (with items delineated in shown in Figure 2. Mean scores for . Because these were the first measures of these student interests, they will be used as baseline against which future annual measures will be compared. Students responded on a seven-point scale ranging from 1= "strongly disagree through 4= "neither disagree nor agree" to 7= "strongly agree". Cronbach's alpha using all items was .83.

Figure 2. Mean scores for four dimensions of interest in science.

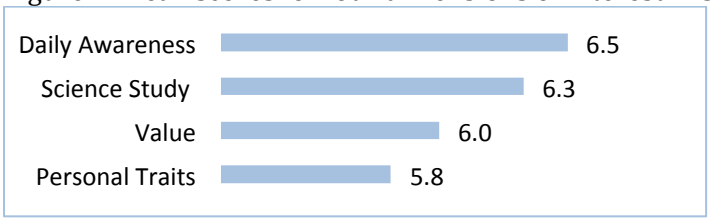
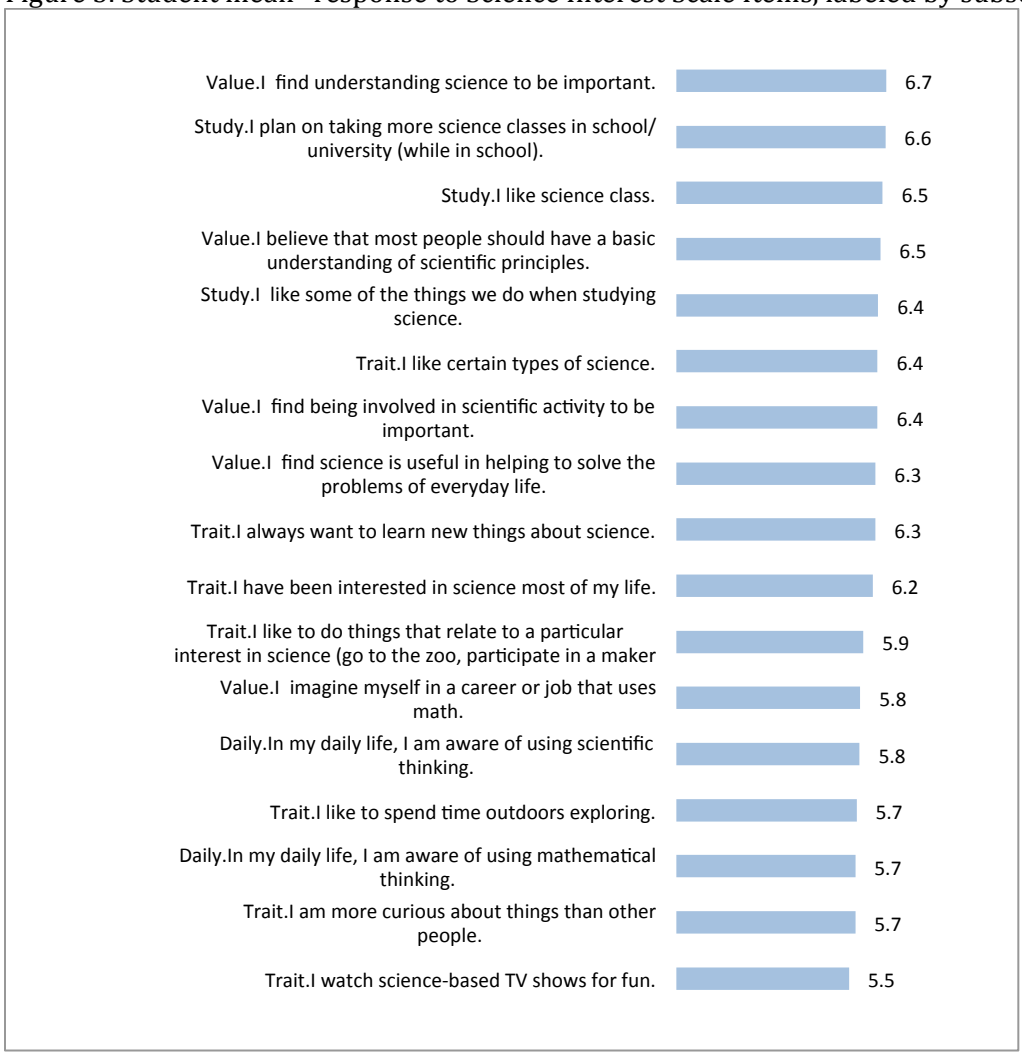


Figure 3. Student mean* response to Science Interest Scale Items, labeled by subscale.



* All standard deviations were less than 1.5

By research group. **The mean Science Interest was significantly lower at the Bronx Zoo** ($\bar{X}$ = 5.7, *s.d.*=.5;) than at Central Park ($\bar{X}$ = 6.3, *s.d.*=. 5;) or Prospect Park ($\bar{X}$ = 6.3, *s.d.*=.5; and did not differ from the Queens Zoo; $\bar{X}$ = 6.1 *s.d.*=.4). The same difference, though with insignificant magnitude could be seen throughout the five science-interest domains. There were no differences by sex, language, or GPA.

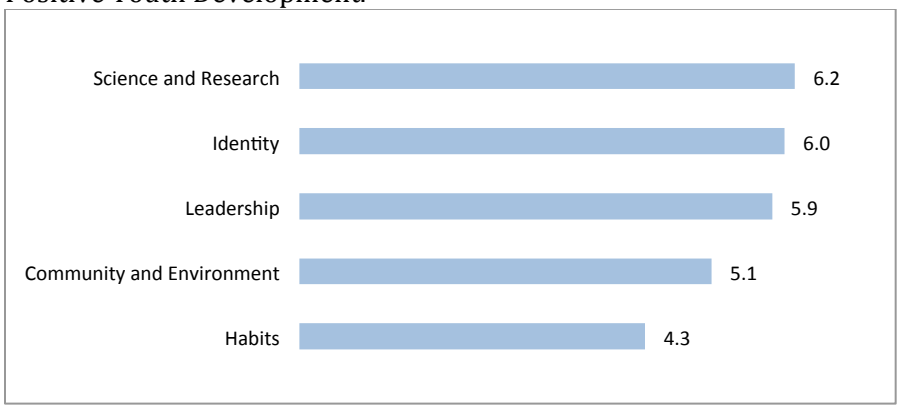
Positive Youth Development

Another measure of short term outcomes was student perception of the effect of Project TRUE on five aspects of positive youth development --Habits, Involvement with Science and Research, Community and Environment, Leadership, and Identity (Damon, 2004; Koke et al., 2007). While these measures give some indication of what students believe they received from their experience, they also function as baseline data to compare against students' longer term perspectives on how Project TRUE affected them.

In response to statements about the effect of Project TRUE (see Figure 6 below) students rated items within each of the five subscales on a seven-point scale ranging from 1= "not at all" through

7= "A lot." Mean scores for each of the subscales, presented in Figure 4, ranged from 6.2 to 4.3 with standard deviations ranging from .9 to 1.4.

Figure 4. Mean scores* for five dimensions of student perceptions of effect of Project TRUE on Positive Youth Development.

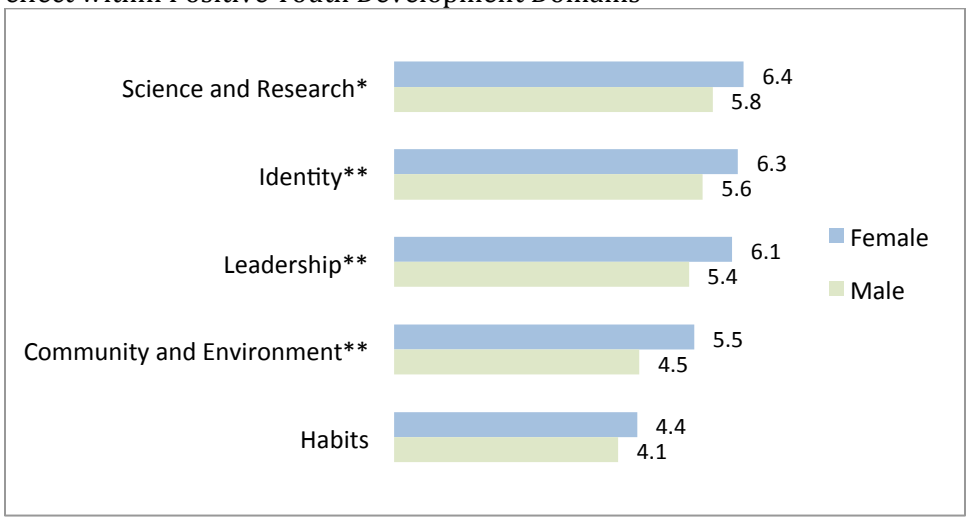


* Standard deviations ranged from .9 to 1.4

Females perceived themselves as gaining significantly more than males in all areas but habits. Means for each group can be found in Figure 5. Further analysis revealed no differences between students grouped by GPA (above 3.5 and others) or by Language (dual language learners vs. others) revealed no differences.

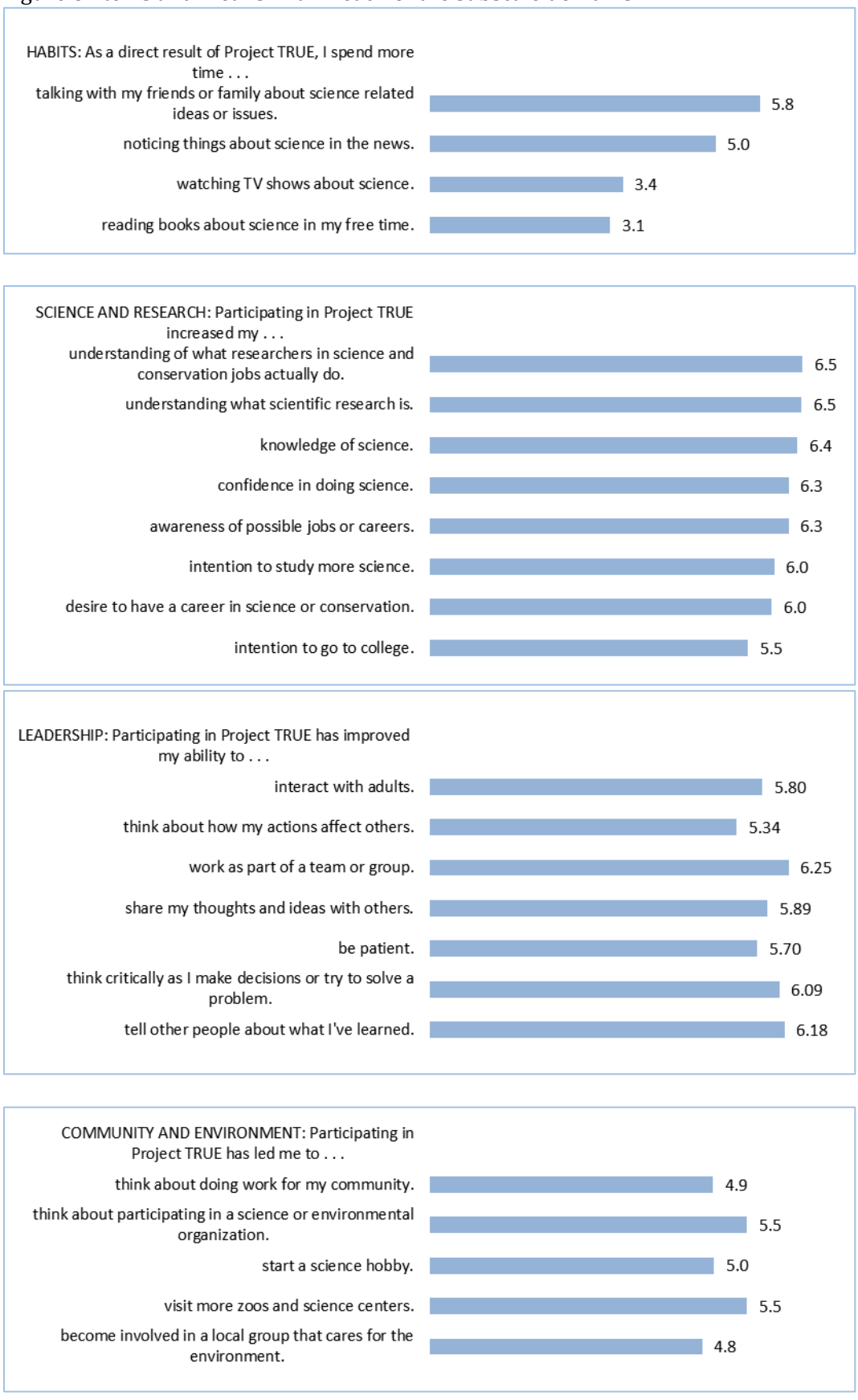
Students at Prospect Park reported significantly more PYD effect on Contribution to Community and Enviroment than students at Queens Zoo.

Figure 5. Significant differences between males and females in their perceptions of Project TRUE's effect within Positive Youth Development Domains



* p<.1; **p<.05; Standard deviations ranged from .9 to 1.5

Figure 6. Items and means within each of the subscale domains.



Hands-On STEM experience and interaction with Peers who Share STEM Interest

To assess the effect of the hands-on STEM experience, guided by self-determination theory, we assessed the motivational quality of the Project TRUE experience for each student. More specifically, based on the postulate that satisfaction of the three basic psychological needs (for sense of relatedness, sense of competence, and sense of autonomy)(Deci & Ryan, 2005) will lead to high quality, internalized motivation and basic psychological need frustration will lead to poor-quality, externalized motivation (Ryan & Deci, 2000). Thus, using the Basic Psychological Need Satisfaction and Frustration measure (Chen et al., 2014), we tested for students' experiences of competence, relatedness and autonomy (i.e. choice making aligned with self regulation in such a way that it is free from tension, pressure, or ambiguity).. Following the basic psychological needs sub theory of self-determination theory (Deci & Ryan, 2000; Ryan & Deci, 2000), students who experienced their needs as satisfied would predictably have longer-lasting learning outcomes than those who experienced their needs as thwarted. For both scales, students responded to 9 items (three for each basic psychological need) on a five-point Likert scale ranging from 1 ="Not at all true" to 5 = "Completely true". The mean Basic Psychological Need Frustration score was 1.6 (*std. dev.=1.7*) with a scale reliability *alpha* of .82. The mean Basic Psychological Need Satisfaction score was 4.3 (*std. dev.*=.48) with a scale reliability alpha of .82.

Female participants felt greater satisfaction and less frustration of their basic psychological needs than did male participants. More specifically, girls felt more sense of relatedness (i.e., "connected with people who cared for me and for whom I cared (t=2.20, df=42, p=.033); "experienced a warm feeling with the people I spent time with" (t=2.017, I=42, p =.05); and to a lesser extent a sense of autonomy (e.g., I felt I was doing what really interests me"; t=1.82, df=17.2, p = .09).

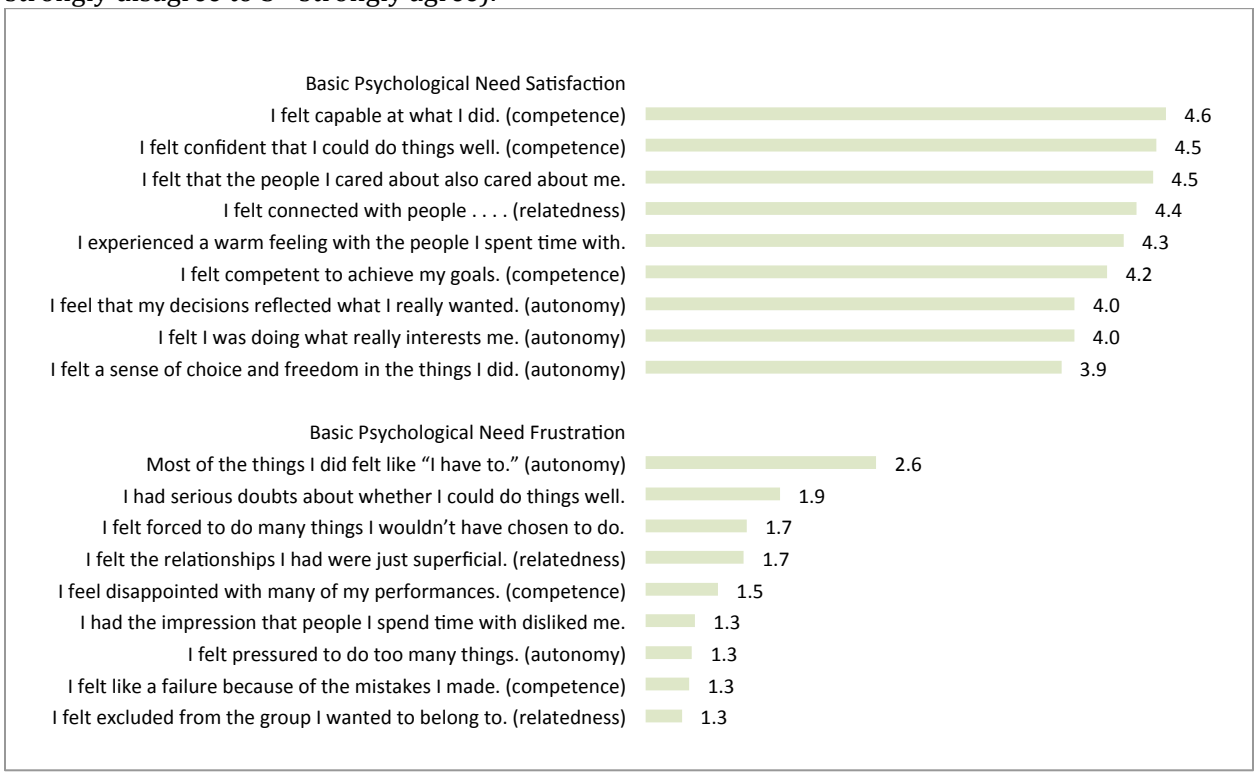
On the other hand, boys felt more frustrated in their sense of competence. E.g., I feel disappointed with many of my performances; and I felt like a failure because of the mistakes I made. More also felt "excluded from the group I wanted to belong to."

F=2.811; p=.052
Students at the Queen Zoo had significantly lower Need Frustration than at the highest scoring Central Park Zoo. Need Satisfaction did not differ by site. Means and standard deviations can be found in Table 6. Individual item scores are presented in Figure 7.

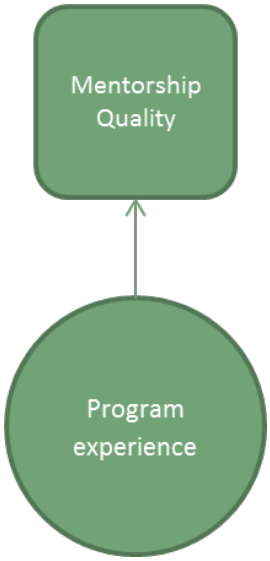
Table 6. Basic Psychological Need Satisfaction and Frustration across zoo sites.

Basic Psychological Need		N	Mean	Std. Deviation
Frustration	Queen Zoo	11	1.35	.28
	Bronx Zoo	9	1.42	.41
	Central Park Zoo	9	1.97	.78
	Prospect Park Zoo	15	1.73	.58
	Total	44	1.62	.57
Satisfaction	Queen Zoo	11	4.33	.48
	Bronx Zoo	9	4.43	.43
	Central Park Zoo	9	4.16	.46
	Prospect Park Zoo	15	4.20	.54
	Total	44	4.27	.48

Figure 7. Ratings of elements of Basic Psychological Need Satisfaction and Frustration (range : 1= strongly disagree to 5= strongly agree).



Quality of this Cohort's "Exposure to a role model"

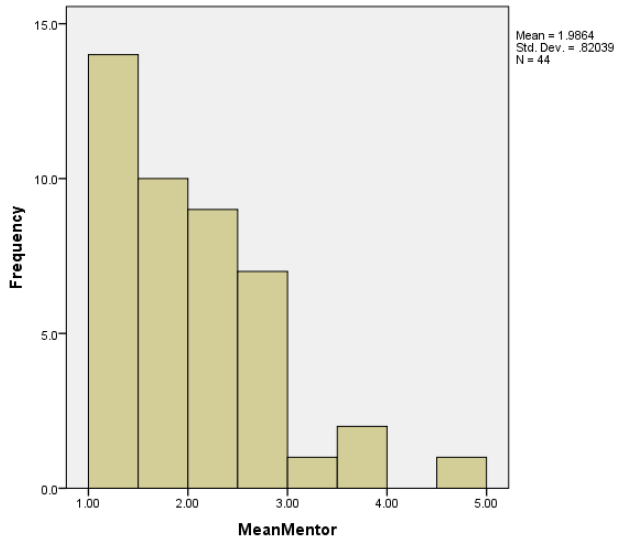


To measure the potential effect of exposure to a role model or mentor, students responded to a –item subscale using a seven point Likert-type scale that ranged from 0 = "Strongly Disagree" through 0= Neutral to 7 = "Strongly Agree". These data will be utilized in future analyses to see how much the quality of the mentor relationship contributes to long-term career choice.

According to the scale authors, the predominantly negative scale items reflect research has shown that the negative aspects of caring relationships outweigh positive ones and that positive interactions are far more frequent than negative ones (Rhodes et al., 2005).

As seen in the histogram in Figure 8, responses were highly skewed toward disagreement with negative statements. In other words, in general, students experiences positive relationships with their mentors. Mean scores for individual statements can be found in Figure 9.

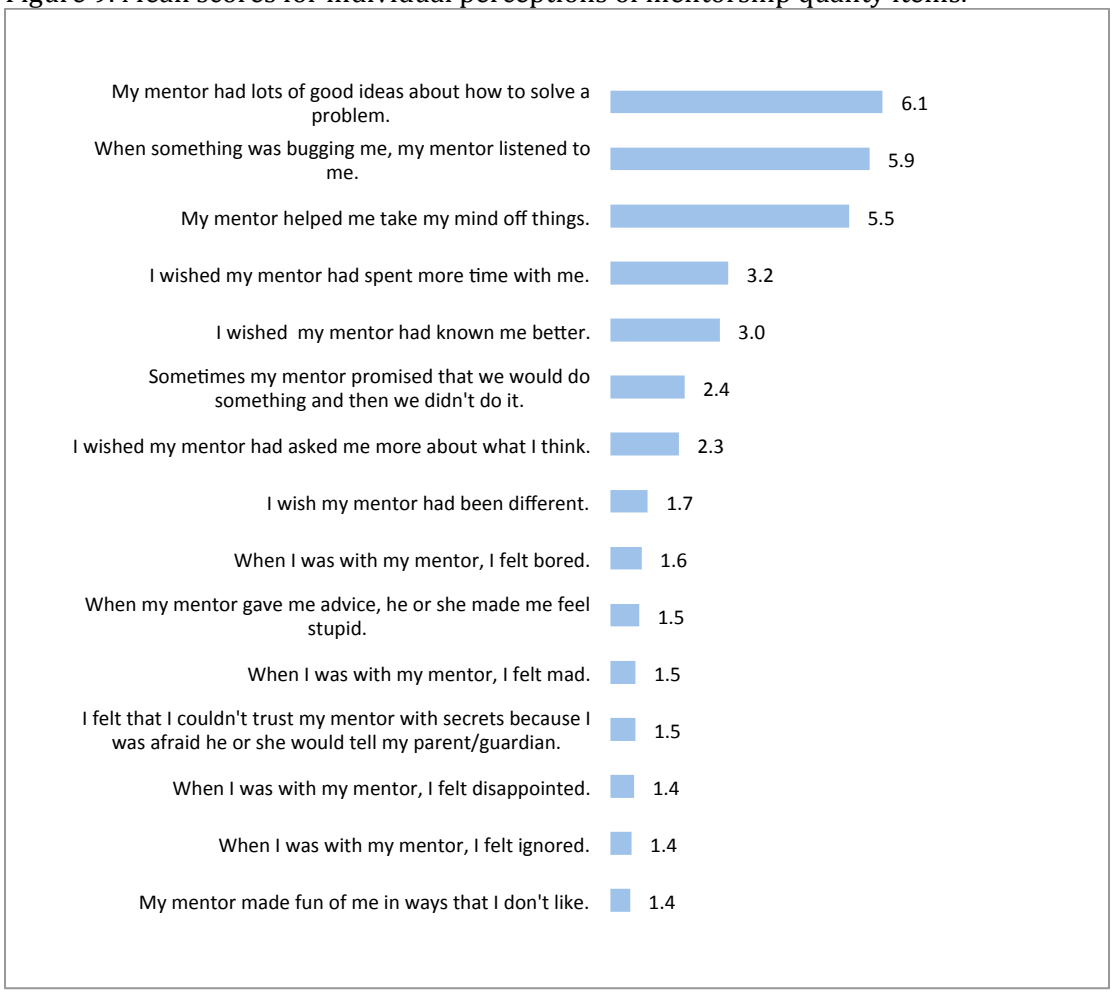
Figure 8. Student mean responses to mostly negative statements about their relationship to their mentors were highly skewed toward disagreement.



Perceptions of mentorship quality did not differ by sex, language, gpa, or research group.

There were high correlations between the student perceptions of mentorship quality and both Basic Psychological Need Frustration (*Pearson r*= .496, *p*=.001) and Satisfaction (*r* =-4.55, *p* = .002), and with the mean Project TRUE influence (*r*=-.298, *p*=.049). These relationships persisted when controlling for sex. There were no significant correlations between mentor scores and positive youth development subscale scores.

Figure 9. Mean scores for individual perceptions of mentorship quality items.



Results Addressing Research Question #3:

To what degree do other, non-program factors known to be influencers (i.e., parental support; in-school exposure; etc.) play into STEM study/career choices – either limiting or enhancing the contribution of program?

Summary of what we learned

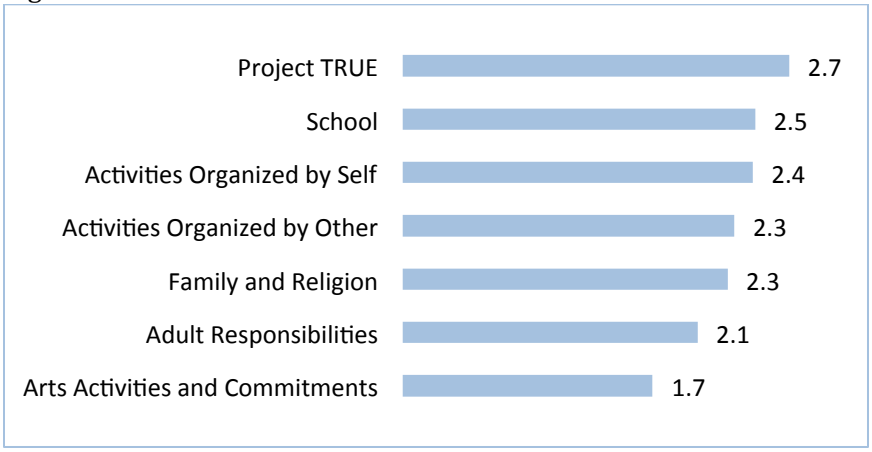
- Of all the external factors that might influence students' choices and decisions, at least for these students' final program day, Project TRUE ranked highest.

- Students' level of being influenced by self-organizing activities correlated with how much they experienced their Project TRUE experience as affecting their positive development.

Influences

To account for factors that influence students' interest in science, seventeen items were divided into 7 subscales shown in Figure 10. On the last day of the Project TRUE experience, of all seven interest areas, students reported that Project TRUE (mentors and the experience itself) exerted the most "positive influence" on "" who you are today" and "where you want to go in the future in terms of school, career, and life." Students responded on a three-point scale ranging from no influence=1 to 2="somewhat" and 3= "a lot".

Figure 10. Seven dimensions of influences on students' interest in science.



Compared to male students, female students reported being more influenced by Activities Organized by Self (female $\bar{X}$ *=2.6,* male $\bar{X}$ *=2.1; t*=2.95, *df*=17.85, *p*=.009, equal variances not assumed*)* and by Project TRUE *(*female $\bar{X}$ *=2.8,* male $\bar{X}$ =2.4*; t*=3.07, *df*=18.20, *p*=.006, equal variances not assumed*)*.

Some areas of extra-program influence correlated highly with other variables. More specifically, **students' level of being influenced by self-organized activities correlated positively with:**

- Mean influence of TRUE (r = .493, p = .001)
- PYD Habits (r =.281, p = .065)
- PYD Community and Environment (r = .525, p<.001)
- PYD Leadership (r =.374, p =.013)
- PYD Identity (r =.570, p <.001)
- Science interest (r = .507, p <.001)
- Basic Psychological Need Satisfaction (but not frustration; r =.359, p = .017)

Family/Religious influence correlated with interest in studying science (r =.306, p =.044).

School influence correlated with:

- TRUE influence (r =.391, p =.009)
- Science interest (r =.376, p = .012)

Conclusion

Through the discussion with the Project TRUE leadership team and Evaluator, we have identified some necessary data collection amendments. As a result we will:

1. Shift the Influences scale from a 3-point to a 7-point scale.
2. For the influence scale, we will add the qualitative question, "For what reasons did you rate Project TRUE as you did?
3. We will also add the question, "With whom in your Project TRUE cohort do you continue to communicate?

Finally, in a separate report, these findings relevant to the program's formative evaluation will be merged with the program evaluation findings. Some topics for consideration include:

- The potential for including an understanding of motivational quality (basic psychological need satisfaction) in mentor preparation.
- A relationship may exist between the outside influence of friends and both identity-related positive youth development and interest in science. This potential relationship will be better after studies of the influence scales are expanded to provide a better sense of magnitude.
- Analysis of basic psychological need frustration scores along with comments led the group to consider that choice of research topic could become more transparent and student directed learning more encouraged. Grad student and mentor trainings may need to include more educational-psychology-related objectives.

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Appendix : On-line Post-Program Questionnaire

Thanks so much for answering the Project TRUE After-Program questionnaire. Your responses are contributing to another kind of scientific study -- a social science study that is exploring the effect of these kinds of programs on young people's interest in pursuing scientific learning and careers.

Some of the questions ask about things that have influenced your life. Others ask about different things that reflect how interested you are in science and math. Don't worry--it's not a test. It's just about you--so you already know all the answers! And thanks so much for participating in this study!

First we'd like you to think of the many conditions that ***positively*** influence your interests and decisions. Look across the list below. How much has each condition positively contributed to who you are today? How much does it contribute to where you want to go in the future in terms of school, career, and life?

For each condition, please mark if it has influenced you "not at all", "somewhat," or "a lot".

	Not at all	Somewhat	A lot
Parents/guardians	❍	❍	❍
Friends	❍	❍	❍
School classes	❍	❍	❍
School teachers	❍	❍	❍
Religious groups/religious education	❍	❍	❍
Visual arts	❍	❍	❍
Performing arts	❍	❍	❍
After-school programs	❍	❍	❍
Organized sports (including school)	❍	❍	❍
Hobbies	❍	❍	❍
Being in nature/being outside	❍	❍	❍
Work/my job	❍	❍	❍
Having to support myself	❍	❍	❍
Living on my own	❍	❍	❍
Extra-curricular activities (school clubs)	❍	❍	❍
Volunteering	❍	❍	❍
Other adults in my life	❍	❍	❍
Family expectations for school	❍	❍	❍
Family expectations for career	❍	❍	❍
My participation in Project TRUE	❍	❍	❍
My Project TRUE mentor	❍	❍	❍

The next statements are about your interest in science. We're not talking just about science as in classes, but how science and math are of interest and use in your life in all sorts of ways. When you respond to each item, we want to know about you!

For each of the qualities listed, please tell us how much you agree or disagree that the statement reflects you.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
In my daily life, I am aware of using scientific thinking.	❍	❍	❍	❍	❍	❍	❍
In my daily life, I am aware of using mathematical thinking.	❍	❍	❍	❍	❍	❍	❍
I plan on taking more science classes in school/university (while in school).	❍	❍	❍	❍	❍	❍	❍
I like science class.	❍	❍	❍	❍	❍	❍	❍
I have been interested in science most of my life.	❍	❍	❍	❍	❍	❍	❍
I am more curious about things than other people.	❍	❍	❍	❍	❍	❍	❍
I like to do things that relate to a particular interest in science (go to the zoo, participate in a maker faire, do a science fair project, etc.).	❍	❍	❍	❍	❍	❍	❍
I like certain types of science.	❍	❍	❍	❍	❍	❍	❍
I like to spend time outdoors exploring.	❍	❍	❍	❍	❍	❍	❍
I watch science-based TV shows for fun.	❍	❍	❍	❍	❍	❍	❍
I always want to learn new things about science.	❍	❍	❍	❍	❍	❍	❍
I like some of the things we do when studying science.	❍	❍	❍	❍	❍	❍	❍
I find understanding science to be important.	❍	❍	❍	❍	❍	❍	❍
I find being involved in scientific activity to be important.	❍	❍	❍	❍	❍	❍	❍
I imagine myself in a career or job that uses math.	❍	❍	❍	❍	❍	❍	❍
I find science is useful in helping to solve the problems of everyday life.	❍	❍	❍	❍	❍	❍	❍
I believe that most people should have a basic understanding of scientific principles.	❍	❍	❍	❍	❍	❍	❍

Now we'd like to know a bit about your experience in Project TRUE. Please complete the following statements:

In my experience of project TRUE, generally speaking. . .	Not true at all	2	3	4	Completely true
. . . I felt a sense of choice and freedom in the things I did.	❍	❍	❍	❍	❍
. . . most of the things I did felt like "I have to."	❍	❍	❍	❍	❍
. . . I felt that the people I cared about also cared about me.	❍	❍	❍	❍	❍
. . . I felt excluded from the group I wanted to belong to.	❍	❍	❍	❍	❍
. . . I felt confident that I could do things well.	❍	❍	❍	❍	❍
. . . I had serious doubts about whether I could do things well.	❍	❍	❍	❍	❍
. . . I feel that my decisions reflected what I really wanted.	❍	❍	❍	❍	❍
. . . I felt forced to do many things I wouldn't have chosen to do.	❍	❍	❍	❍	❍
. . . I felt connected with people who cared for me, and for whom I cared.	❍	❍	❍	❍	❍
. . . I felt capable at what I did.	❍	❍	❍	❍	❍
. . . I feel disappointed with many of my performances.	❍	❍	❍	❍	❍
. . . I felt pressured to do too many things.	❍	❍	❍	❍	❍
. . . I had the impression that people I spend time with disliked me.	❍	❍	❍	❍	❍
. . . I felt competent to achieve my goals.	❍	❍	❍	❍	❍
. . . I felt I was been doing what really interests me	❍	❍	❍	❍	❍
. . . I experienced a warm feeling with the people I spent time with	❍	❍	❍	❍	❍
. . . I felt the relationships I had were just superficial.	❍	❍	❍	❍	❍
. . . I felt like a failure because of the mistakes I made.	❍	❍	❍	❍	❍

As a direct result of Project TRUE, I spend more time. . .	Not at all	2	3	4	5	6	A lot
. . . watching TV shows about science.	❍	❍	❍	❍	❍	❍	❍
. . . reading books about science in my free time.	❍	❍	❍	❍	❍	❍	❍
. . . noticing things about science in the news.	❍	❍	❍	❍	❍	❍	❍
. . . talking with my friends or family about science related ideas or issues.	❍	❍	❍	❍	❍	❍	❍

Participating in Project TRUE increased my. . .	Not at all	2	3	4	5	6	A lot
. . . knowledge of science.	❍	❍	❍	❍	❍	❍	❍
. . . confidence in doing science.	❍	❍	❍	❍	❍	❍	❍
. . . understanding what scientific research is.	❍	❍	❍	❍	❍	❍	❍
. . . desire to have a career in science or conservation.	❍	❍	❍	❍	❍	❍	❍
. . . intention to go to college.	❍	❍	❍	❍	❍	❍	❍
. . . intention to study more science.	❍	❍	❍	❍	❍	❍	❍
. . . awareness of possible jobs or careers.	❍	❍	❍	❍	❍	❍	❍
. . . understanding of what researchers in science and conservation jobs actually do.	❍	❍	❍	❍	❍	❍	❍

Participating in Project TRUE has led me to . . .	Not at all	2	3	4	5	6	A lot
. . . think about doing work for my community.	❍	❍	❍	❍	❍	❍	❍
. . . think about participating in a science or environmental organization.	❍	❍	❍	❍	❍	❍	❍
. . . start a science hobby.	❍	❍	❍	❍	❍	❍	❍
. . .visit more zoos and science centers.	❍	❍	❍	❍	❍	❍	❍
. . . become involved in a local group that cares for the environment.	❍	❍	❍	❍	❍	❍	❍

Participating in Project TRUE has helped me feel . . .	Not at all	2	3	4	5	6	A lot
. . .confident to try new things.	❍	❍	❍	❍	❍	❍	❍
. . . more sure of what my strengths and weaknesses are.	❍	❍	❍	❍	❍	❍	❍
. . . able to accept responsibility.	❍	❍	❍	❍	❍	❍	❍
. . . willing to take on a leadership role.	❍	❍	❍	❍	❍	❍	❍
. . . want to help take care of the environment.	❍	❍	❍	❍	❍	❍	❍
. . . I have a good future ahead of me.	❍	❍	❍	❍	❍	❍	❍
. . .I am a part of nature.	❍	❍	❍	❍	❍	❍	❍
. . . I have better science skills.	❍	❍	❍	❍	❍	❍	❍
. . . I have better research skills.	❍	❍	❍	❍	❍	❍	❍

Participating in Project TRUE has improved my ability to. . .	Not at all	2	3	4	5	6	A lot
. . . interact with adults.	❍	❍	❍	❍	❍	❍	❍
. . . think about how my actions affect others.	❍	❍	❍	❍	❍	❍	❍
. . . tell other people about what I've learned.	❍	❍	❍	❍	❍	❍	❍
. . . work as part of a team or group.	❍	❍	❍	❍	❍	❍	❍
. . . share my thoughts and ideas with others.	❍	❍	❍	❍	❍	❍	❍
. . . be patient.	❍	❍	❍	❍	❍	❍	❍
. . . think critically as I make decisions or try to solve a problem.	❍	❍	❍	❍	❍	❍	❍

Now please think of your Project TRUE mentor and respond to each statement below according to how much you agree or disagree. Remember that your responses are confidential and not identified with your name so you can be entirely candid!

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
When something was bugging me, my mentor listened to me.	❍	❍	❍	❍	❍	❍	❍
My mentor had lots of good ideas about how to solve a problem.	❍	❍	❍	❍	❍	❍	❍
My mentor helped me take my mind off things.	❍	❍	❍	❍	❍	❍	❍
Sometimes my mentor promised that we would do something and then we didn't do it.	❍	❍	❍	❍	❍	❍	❍
My mentor made fun of me in ways that I don't like.	❍	❍	❍	❍	❍	❍	❍
I wish my mentor had been different.	❍	❍	❍	❍	❍	❍	❍
When I was with my mentor, I felt disappointed.	❍	❍	❍	❍	❍	❍	❍
When I was with my mentor, I felt ignored.	❍	❍	❍	❍	❍	❍	❍
When I was with my mentor, I felt bored.	❍	❍	❍	❍	❍	❍	❍
When I was with my mentor, I felt mad.	❍	❍	❍	❍	❍	❍	❍
I felt that I couldn't trust my mentor with secrets because I was afraid he or she would tell my parent/guardian.	❍	❍	❍	❍	❍	❍	❍
When my mentor gave me advice, he or she made me feel stupid.	❍	❍	❍	❍	❍	❍	❍
I wished my mentor had asked me more about what I think.	❍	❍	❍	❍	❍	❍	❍
I wished my mentor had known me better.	❍	❍	❍	❍	❍	❍	❍
I wished my mentor had spent more time with me.	❍	❍	❍	❍	❍	❍	❍
When something was bugging me, my mentor listened to me.	❍	❍	❍	❍	❍	❍	❍
My mentor had lots of good ideas about how to solve a problem.	❍	❍	❍	❍	❍	❍	❍

Now some questions just about you!

Thinking about the future, are you planning to go to college?

- ❍ Yes
- ❍ No

If so, at the beginning of the summer, before you participated in Project TRUE, what academic subjects did you think you might pursue in college?

Now that you have participated in Project TRUE, have your interests changed at all? Now what academic subjects do you plan to pursue?

For what reasons have you chosen the academic interests you listed above?

Right now, if you had to choose, what would your career be?

Thanks so much for responding to this questionnaire! We deeply appreciate your time and thoughts.