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Effects of Summer Academic Programs in Middle School on High School Test Scores, Course-Taking, and College Major

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Although the majority of a student's academic experiences take place during the school year, summer enrichment programs provide important opportunities for students who are seeking further academic stimulation. Researchers propose that underachievement in gifted students often occurs because the school is frequently the only avenue for gifted children to express their academic and creative talents (Emerick, 1992; Enersen, 1993).

Through their participation in a seventh-grade talent search in 1996–1997, students qualified to attend a summer program at Duke University's Talent Identification Program (Duke TIP). Of the North Carolina students in this group, some attended at least one summer program in middle school and others had qualified for but did not attend a summer program at Duke TIP. The two groups did not differ significantly on gender, parent education level, or ethnicity. Some positive effects of Duke TIP summer programs were found on later academic achievement and educational choices using both standardized objective measures and self-reports of high school and college academic experiences. We found that students who participated in a Duke TIP math program in middle school did indeed take more AP math courses in high school, but there were no effects for other types of advanced math classes or for any other subjects. Additionally, compared to Search Only students, students who took a math/science course at Duke TIP were more likely to major in math/science in college. More Duke TIP students than Search Only students aspired to earn a doctorate. Anecdotally, we also have heard from many former Duke TIP participants how much Duke TIP has affected their lives, and it is noteworthy that we are now able to empirically document some of these effects.

summary

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The sole reliance on schools as a means of developing talent leads to the limiting of the gifted child's ability (Enersen, 1993; Feldhusen, 1991; Kanevsky & Keighley, 2003). Numerous studies have shown that the lack of gifted programming in many middle and high schools leads to underachievement among gifted students because schools are unable to meet the needs of these students (Campbell, Wagner, & Walberg, 2000; Cross & Coleman, 1993; Emerick, 1992; Kanevsky & Keighley, 2003).

The summer months outside of school have been found to be detrimental to the academic advancement of students (Entwistle & Alexander, 1992), but this time away from academics may take a particularly worse toll on gifted students who may become bored and subsequently underachieve in the following school year. According to Emerick (1992), finding another source of educational enrichment can reverse that trend. Gifted students enjoy classes that provide advanced topics, intellectual challenge, and opportunities for student discussion without an emphasis on grades (Emerick, 1992; Kanevsky & Keighley, 2003). A major benefit of academic enrichment programs is that they provide opportunities for interaction with equally able and motivated peers (Campbell et al., 2000). They also provide valuable role models who have an academic orientation. In a qualitative study about students' experiences in summer residential programs, Enersen (1993) found that experiencing challenging coursework while living on a college campus was highly important to the gifted students. Siegle and McCoach (2004) suggested that gifted students pursue activities in which they feel they have skill and which they perceive as friendly and reinforcing. Furthermore, educational aspirations and perceptions of academic abilities influence students' decisions about school (Reynolds & Conaway, 2003; Siegle & McCoach, 2004).

Approximately 16,000 students participate annually in summer programs for academic enrichment and acceleration through six talent search centers in the U.S. (Lee, Matthews, & Olszewski-Kubilius, 2008). Positive effects of summer programs on gifted students' social development and psychological well-being have been reported in the literature. For example, summer programs increase students' self-concepts (Cunningham & Rinn, 2007; Olszewski, Kulieke, & Willis, 1987) and promote positive changes in social relationships and self-perceptions as a result of being with intellectual peers (Cross & Coleman, 1993; Neihart, 2004; Silverman, 1993).

Although the academic enrichment courses offered in summer programs often only last a few weeks, the impact that they have on gifted students' academic performance and educational patterns can be long lasting (Barnett & Durden, 1993; Benbow & Lubinski, 1996; Emerick, 1992; Lubinski & Benbow, 2006). For example, summer programs may help to prevent underachievement (Emerick, 1992), they are associated with attendance at more highly ranked colleges (Barnett & Durden, 1993), they may boost attendance in graduate school for females (Swiatek & Benbow, 1991), and they may increase students' educational aspirations (Olszewski-Kubilius & Grant, 1996). In one of the few large longitudinal studies, 13-year-old students who participated in an accelerated math course at the Johns Hopkins' Study of Mathematically Precocious Youth (SMPY) were found more likely to be in math-science career tracks 10 years later compared to eligible students who did not take such a course (Benbow, 2006). Other SMPY studies have shown similar results (for reviews, see Benbow & Lubinski, 1996; Lubinski & Benbow, 2006).

Rigorous courses offered in summer programs can prepare students for advanced-level courses in their schools (Mills, Ablard, & Lynch, 1992). In one of the most relevant studies, Barnett and Durden (1993) conducted follow-up mail surveys of talent search participants who qualified to attend a summer program. They found that those who had attended a Johns Hopkins University Center for Talented Youth (CTY) course reported taking Advanced Placement courses earlier and reported taking more college-level courses in high school than those who had not. Olszewski-Kubilius and Grant (1996), in another relevant study, reported that taking math in a summer program was especially beneficial for academically talented females.

To our knowledge, no study has used state-level public school data to track students' school achievements after their participation in a talent search or summer program for the academically talented. This paper contains two studies: Study 1 follows students after they attended a summer residential program for the academically gifted in middle school, examining their public school achievement test scores in high school; Study 2 examines their self-reported high school and college academic experiences.

The Current Set of Studies

These studies use data from the Duke University Talent Identification Program (Duke TIP). Founded in 1980, Duke TIP has thus far benefited more than 1.8 million gifted youth. For an overview of the Duke TIP model, see Putallaz, Baldwin, and Selph (2005). TIP's mission is threefold: to identify and serve academically gifted and talented young people; to provide innovative, challenging, and highly motivating educational programs; and to conduct research on the nature of academic talent and giftedness. The identification aspect of Duke TIP's mission is accomplished in part through Duke TIP's seventh-grade Talent Search Program, which identifies talented youth through above-level college-entrance exams. Students who score at the 95th percentile or higher on at least one subscale of a fifth- or sixth-grade standardized achievement test in their state are eligible to participate in the Talent Search. Interested students then take the SAT (or ACT) and must meet the qualification criteria to participate in Duke TIP's educational programs. Qualification for Duke TIP summer programs is based on SAT scores (or equivalent ACT scores). Seventh-grade students who had either an SAT-V of at least 570 or an SAT-M score of at least 570 qualify for *Center* level programs. Students who score greater than a 500 but less than a 570 on either the SAT-V or the SAT-M qualify for *Academy* level programs. Students at both levels are considered "qualified." The rationale for classifying students into the Center level versus the Academy level is to allow students to experience curricula that are appropriate to their ability level. Classes at the Center level are more academically rigorous (i.e., faster paced and more in-depth) than those at the Academy level.

In Duke TIP's 3-week summer residential programs, students are in class for 7 hours on weekdays and 3 hours on Saturday. The curriculum is fast-paced, rigorous, and innovative, and courses are similar to those offered to undergraduate students in select, competitive universities. The courses combine elements of enrichment and acceleration, and are nongraded to encourage intellectual risk-taking. Unlike typical middle or high schools, Duke TIP allows students to pick their classes. Classes that students find interesting, challenging, and relevant are likely to promote achievement (Emerick, 1992; Enersen, 1993). Emerick found that classes that provide intellectual challenge and opportunities for student discussion and those that minimize the importance of grades while emphasizing the learning process encourage the highest levels of achievement among gifted students. Furthermore, teachers at Duke TIP and other similar summer programs are genuinely interested in and involved with the students, an aspect of schooling that is highly influential in student success but often is lacking at these students' home schools (Emerick, 1992; Enersen, 1993). Factors such as the rigor of the course, the high motivation and interest of students, and highly engaged teachers enhance students' learning experience, cultivate their pursuit in the course subject area, and influence their educational aspirations and future academic performance. A previous study involving students who participated in the Duke TIP talent search found that students who participated in summer accelerated programs obtained higher ACT math scores in high school than students who had equivalent scores on the talent search testing but had not participated in any summer programs (Schiel & Stocking, 2001).

The current research examines the effect of Duke TIP summer programs on gifted youth's academic performance by employing a quasi-experimental design. In two studies, we compared gifted youth who qualified for and attended Duke TIP to a control group consisting of those who qualified for but chose not to attend a Duke TIP summer program. The first study examines the high school state achievement test scores of these two groups of students; the second study examines students' advanced course-taking in high school, choices of college majors, high school and college GPAs, and educational aspirations. These two studies are interrelated in several aspects. First, both studies examine the same general research question: namely, whether there is any long-term effect of Duke TIP summer program participation on gifted students' academic performance. These two studies examine the general research question from two different but complementary angles. Second, participants in the two studies were overlapping, as they were all drawn from the 1996 and 1997 talent search. Presenting the two studies together provides a comprehensive examination of the long-term effect of Duke TIP summer programs using the same cohorts (i.e., 1996 and 1997 cohorts) of gifted youth. Given that summer programs allow gifted students to experience academic enrichment in a rigorous academic setting with other gifted classmates, we expect that the effects of such a program will be long-lasting academically. Specifically, if students who attend such a program in an area of interest are sufficiently challenged and inspired, they may be more likely to engage in the subject and thus perform better academically. They also may be more likely to pursue advanced coursework or a college major in the same subject area.

Study 1

Method

Participants. Participants of this study included students who qualified for Duke TIP summer programs according to the Duke TIP talent search criteria in 1996 and 1997. Due to the availability of a comprehensive statewide educational database, only students who had North Carolina (NC) public school records were included. Additionally, students who participated in any Duke TIP summer program in high school were excluded from the data analysis in order to provide a more stringent test of the effects of middle school participation. The qualified students had up to two summers in middle school years (i.e., summers following seventh and eighth grades) to participate in Duke TIP summer programs. The majority of the Duke TIP students participated in Duke TIP summer programs once in middle school. A few students participated more than once. Given the low frequency of students who participated in summer programs more than once, we decided to collapse all of the students who participated in Duke TIP summer programs at least once into one group. This group of students was labeled *TIP* students. They were compared with the *Search Only* students who were qualified but chose not to attend a Duke TIP summer program.

The dataset used in this study combined Duke TIP Talent Search data with public school records from the North Carolina Department of Public Instruction (DPI). The DPI records we used for this study were end of course (EOC) scores from grades 9–12. High school students in North Carolina take one or more of 10 available EOC tests after they have taken the associated course at their school, which could be in any year from grades 9–12. Student records of those students who qualified for summer programs through the seventh-grade Talent Search in either 1996 or 1997 were matched with their public school records in the North Carolina Education Research Data Center (NCERDC), which houses the DPI data at Duke University. The NCERDC returned a dataset in which these students' EOC scores had been merged. The Duke IRB approved this process.

The final sample for Study 1 included 141 students (72 females) from North Carolina who had attended a Duke TIP summer residential program in middle school and 2,649 Search Only students (1,216 females). The majority of the students in both groups were White (73.9% Caucasian in the TIP group and 92.2% Caucasian in the Search Only group). The groups did not differ significantly in terms of their parents' education level (see Table 1). On average, parents in both groups had a 4-year college education. Parental education is an important proxy for socioeconomic status (SES). Although qualified students with a more affluent family background may access academic enrichment programs more easily,

Table 1

Means and Standard Deviations by Duke TIP Participation Status and Gender

	TIP Group		Search Only Group	
	Mean	*SD*	Mean	*SD*
SAT Math	552.87	76.77	511.02	57.09
Male	570.15	81.67	521.66	55.73
Female	535.59	67.81	498.47	56.15
SAT Verbal	519.49	88.04	492.48	66.89
Male	520.00	105.46	485.93	68.20
Female	518.97	67.05	500.20	64.49
Parent Education Level	5.08	1.17	4.97	1.12
Male	5.26	1.06	5.00	1.11
Female	4.93	1.24	4.93	1.14
EOC Algebra I	73.57	6.97	72.28	6.44
Male	74.95	6.27	72.83	6.55
Female	72.62	7.31	71.63	6.27
EOC Algebra II	77.65	7.15	76.82	6.99
Male	79.45	6.78	77.37	6.96
Female	76.60	7.21	76.19	6.98
EOC Geometry	73.19	6.00	74.32	5.79
Male	74.57	6.55	74.80	5.81
Female	72.11	5.41	73.76	5.72
EOC Chemistry	71.97	6.76	70.93	6.32
Male	73.26	7.12	71.86	6.30
Female	70.87	6.28	69.84	6.17
EOC Physics	68.63	7.48	67.44	7.00
Male	69.22	7.91	68.78	6.79
Female	67.94	7.00	65.43	6.83
EOC Biology	71.92	5.48	70.56	4.89
Male	72.99	5.16	71.17	4.87
Female	70.87	5.62	69.84	4.81
EOC ELP	70.39	4.65	69.29	4.52
Male	71.71	4.95	69.76	4.48
Female	69.15	4.00	68.75	4.50
EOC English	70.36	5.11	69.19	4.53
Male	70.14	4.94	68.50	4.48
Female	70.57	5.30	69.99	4.45
EOC U.S. History	70.27	5.62	69.47	5.49
Male	71.96	5.70	70.31	5.49
Female	68.71	5.11	68.49	5.33

Note. ELP = English, law, and political science.

Duke TIP makes a special effort to encourage all qualified students regardless of financial means to participate by providing full or partial scholarships to their summer programs.

Before proceeding, we examined potential gender and group differences on SAT-M and SAT-V using ANOVAs with gender and group status (TIP vs. Search Only) as grouping factors. The TIP group was significantly higher on SAT-M ($F[1, 2733] = 72.83, p < .001$) and SAT-V ($F[1, 2733] = 19.64, p < .001$) than the Search Only group. Males and females (coded 0 and 1, respectively) did not differ on SAT-V; however, males scored higher on SAT-M ($F[1, 2733] = 33.15, p < .001$). No significant gender by group status interaction was found. As SAT scores are used to predict future academic achievement (Donlon, 1984), SAT scores were controlled in subsequent analyses to isolate the effects of Duke TIP program attendance on later test scores.

Analysis Plan. The main research question to be examined in this study was whether students' high school academic outcomes (i.e., EOC scores) were affected by their Duke TIP summer program participation in middle school. Additional research questions included whether the effect of Duke TIP summer program participation depended upon the SAT-M or SAT-V score and gender of the student. Therefore, the interaction effect of SAT score and program participation and the interaction effect of gender and program participation were examined. To assess the unique contribution of each predictor, hierarchical multiple regressions were conducted to obtain the additional variance explained by each predictor (R^2 change). For all regression models, SAT-M or SAT-V scores, gender, Duke TIP program participation, the interaction term of SAT-M or SAT-V scores and program participation, and the interaction term of gender and program participation were entered as predictors in a sequential fashion. SAT-M or SAT-V scores in the regression models were continuous and centered. Due to the considerations of relevance and parsimony for the regression models, either SAT-M or SAT-V was controlled in each regression analysis depending upon the subject of focus: SAT math scores were controlled in math and science models, whereas SAT verbal scores were controlled in social science and English models. Once significant interaction terms were found, separate regression models examining program effect were run for high and low SAT-M or SAT-V groups and/or for male and female groups.

As mentioned earlier, Duke TIP provides somewhat different curricula for students at different achievement levels (classified by SAT scores) to meet their needs for academic enrichment. Therefore, the beneficial effects of Duke TIP summer programs on students' high school performance may depend on students' achievement levels. Consistent with Duke TIP's classification criteria for Center and Academy levels, we used 570 as the criterion to classify students into high versus low SAT-M or SAT-V groups. This classification criterion choice made the analysis more ecologically valid given that students with different SAT scores at the Center versus Academy level would have taken courses that differed in intensity and rigor. It should also be noted that low SAT group is a relative term because all students qualified for Duke TIP summer programs.

As students participated in different course areas, influences of Duke TIP summer programs may affect EOC scores in different areas. Therefore, in addition to overall Duke TIP program participation, five areas of program participation were created and coded: math and computer science, hard science, living science, humanities, and social science. Depending upon the subjects for the EOC scores, different predictors were used in the regressions on the basis of theoretical consideration and relevance. For Algebra I, Algebra II, and geometry EOC scores, students' SAT-M scores, participation in math and computer science, gender, the interaction term of SAT-M scores and program participation, and the interaction term of gender and program participation served as predictors in the model. To render the TIP group and the Search Only group more comparable, a few cases in the Search Only group with lower SAT-M scores than the minimum score in the TIP group were excluded from the data analysis. For instance, if a Search Only student qualified on the basis of his SAT-V score, but his SAT-M score was below that of the lowest in the TIP group, this case would be excluded from the analysis. The remainder of the regression models was similar, except that the program participation was selected to match the respective subjects of EOC scores (see Table 2). For the models predicting chemistry and physics EOC scores, the hard science Duke TIP program participation was used; for the model predicting biology EOC scores, the living science Duke TIP program participation was used.

Similarly, for English, law, and political science (ELP), English, and U.S. history EOC scores, we entered SAT-V scores, Duke TIP humanities program participation, gender, the interaction term of SAT-V scores and program participation, and the interaction term of gender and program participation in the model. To make the TIP group and the Search Only group more comparable, the few cases in the Search Only group with lower SAT-V scores than the minimum SAT-V score in the TIP group were excluded. Additionally, a similar set of models were run for ELP, English, and U.S. history EOC scores with the humanities TIP program participation replaced by social science TIP program participation.

For these regression models, we expected that much of the variance in the outcome variable (EOC scores) would be explained by our control variable (SAT score) as both are achievement tests. However, what is more important and relevant here is to examine the additional variance explained by each additional predictor. Therefore, we included the R^2 change statistics to show the relative contribution of each predictor.

Results

Not surprisingly, the regression models showed that SAT-M scores significantly and positively predicted all of the math- and science-related EOC scores (see Tables 1 and 2). There were no gender differences in EOC performance for math classes, but males performed better than females on the chemistry, physics, and biology EOC tests. There was no significant effect of Duke TIP program participation (math and computer science, hard

Table 2

Hierarchical Regression for Math and Science EOC Scores

Step	Algebra I			Algebra II			Geometry			Chemistry			Physics			Biology		
	R^2	R^2 c	β	R^2	R^2 c	β	R^2	R^2 c	β	R^2	R^2 c	β	R^2	R^2 c	β	R^2	R^2 c	β
1 SAT math	.22	.219***	.47***	.21	.211***	.46***	.25	.245***	.50***	.14	.138***	.37***	.16	.164***	.40***	.07	.069***	.26***
2 SAT math	.22	.000	.47***	.21	.000	.46***	.25	.000	.50***	.15	.007***	.36***	.19	.022***	.37***	.08	.008***	.24***
Gender			.01			.01			.01			-.08***			-.15***			-.09***
3 SAT math	.22	.000	.47***	.21	.000	.46***	.25	.001	.50***	.15	.002*	.36***	.19	.002	.38***	.08	.001	.24***
Gender			.01			.01			.01			-.08***			-.15***			-.09***
TIP program			.01			-.02			-.04			-.04*			-.04			.03
4 SAT math	.22	.003**	.48***	.22	.008***	.49***	.25	.007***	.52***	.15	.000	.36***	.19	.000	.38***	.08	.000	.24***
Gender			.01			.02			.01			-.08***			-.15***			-.09***
TIP program			.04*			.04			.02			-.04*			-.04			.03
SAT math X TIP program			-.07***			-.11***			-.10***			0.01			0.00			.01
5 SAT math	.22	.000	.48***	.22	.000	.49***	.25	.000	.52***	.15	.000	.36***	.19	.000	.38***	.08	.000	.24***
Gender			.01			.02			.01			-.08***			-.15***			-.09***
TIP program			.05			.04			.03			-.06			-.07			.03
SAT math X TIP program			-.07***			-.11***			-.11***			0.01			0.00			.01
Gender X TIP program			-.01			.00			-.02			0.01			0.03			-.01

Note. All models were significant at the .001 level. R^2 c = R^2 change. When the criteria were Algebra I, Algebra II, and geometry EOC scores, the TIP Program meant the participation of the Duke TIP math and computer science programs; when the criteria were chemistry and physics EOC scores, the TIP program meant the participation of Duke TIP hard science programs; and when the criterion was biology EOC scores, the TIP program meant the Duke TIP living science participations.
* $p < .05$. ** $p < .01$. *** $p < .001$.

science, or living science) on Algebra II, geometry, physics, and biology EOC scores. However, chemistry EOC scores appeared to be negatively predicted by Duke TIP hard science program participation in Step 3, although the effect size was small (R^2 change = .002; Cohen, 1988). There was no significant gender by program participation interaction effect. However, there was a statistically significant interaction effect of SAT-M scores and Duke TIP math and computer science program participation on Algebra I, Algebra II, and geometry EOC scores as shown in Step 4. Additionally, in Step 4, TIP math and science program participation positively predicted Algebra I EOC scores.

The significant SAT-M by program participation (math and computer science) interactions on Algebra I, Algebra II, and geometry EOC scores were examined in follow-up hierarchical regressions for high-low SAT-M groups (see Table 3). The high-low SAT-M was classified with a criterion of 570 (.93 *SD* above the mean of SAT-M for the overall sample). Gender by program interactions were not included in the follow-up models because they were not significant in the overall regression models. Therefore, in the follow-up regression models, only gender and participation in TIP math and science programs were included in the model. They were entered in the model in a sequential fashion to examine the R^2 changes.

For the high SAT math group, neither gender nor participation in Duke TIP math and computer science courses significantly predicted Algebra I, Algebra II, and geometry EOC scores. However, for the low SAT-M group, males performed better on the three EOC tests. Additionally, participation in Duke TIP math and computer science programs predicted Algebra I EOC scores at the .10 level. However, the effect size was small for this prediction (R^2 change = .001).

Similar hierarchical regression models were conducted for ELP, English, and U.S. history EOC scores (see Table 4). SAT-V score and gender were both significant predictors of these EOC scores. The SAT-V scores positively predicted students' EOC scores in ELP, English, and U.S. history. Males scored higher than females on ELP and U.S. history (the social science tests),

Table 3

Hierarchical Regression on EOC Scores for High vs. Low SAT-M or SAT-V Groups

Step		Algebra I			Algebra II			Geometry				ELP		
		R^2	R^2 c	β	R^2	R^2 c	β	R^2	R^2 c	β		R^2	R^2 c	β
	High SAT-M Group										**High SAT-V Group**			
1	Gender	.00	.004	-.06	.01	.007	-.08	.02	.023	-.15	Gender	.06	.060***	-.25***
2	Gender	.01	.005	-.06	.01	.000	-.08	.03	.003	-.15	Gender	.06	.000	-.25***
	TIP math and computer science			.07			-.02			-.06	TIP social science			-.01
	Low SAT-M Group										**Low SAT-V Group**			
1	Gender	.00	.003**	-.06**	.00	.002*	-.05*	.00	.004*	-.06*	Gender	.01	.014***	-.12***
2	Gender	.01	.001⁺	-.06**	.00	.001	-.05*	.00	.000	-.06*	Gender	.02	.001	-.12***
	TIP math and computer science			.04⁺			.03			.02	TIP social science			.03

Note. High and low SAT math or verbal groups were classified using 570 as the criterion, which was about .93 SD and 1.09 SD of the SAT-M and SAT-V scores, respectively, for the overall sample. * $p < .05$. ** $p < .01$. *** $p < .001$. ⁺ $p < .10$.

Table 4

Hierarchical Multiple Regressions for Humanities and Social Science EOC Scores

Step		ELP			English			U.S. History		
		R^2	R^2c	β	R^2	R^2c	β	R^2	R^2c	β
	TIP humanities program									
1	SAT-V	.20	.204***	.45***	.22	.221***	.47***	.20	.197***	.44***
2	SAT-V	.23	.025***	.47***	.23	.013***	.46***	.24	.046***	.46***
	Gender			-.16***			.12***			-.22***
3	SAT-V	.23	.000	.47***	.24	.000	.46***	.24	.001	.47***
	Gender			-.16***			.12***			-.22***
	TIP humanities			.00			.02			-.03
4	SAT-V	.23	.000	.46***	.24	.000	.46***	.24	.000	.47***
	Gender			-.16***			.12***			-.22***
	TIP humanities			-.01			.02			-.03
	SAT-V X TIP humanities			.02			.00			.00
5	SAT-V	.23	.000	.47***	.24	.000	.46***	.24	.000	.47***
	Gender			-.16***			.12***			-.21***
	TIP humanities			-.02			.02			-.03
	SAT-V X TIP humanities			.02			.00			.00
	Gender X TIP humanities			.01			.00			.00
	TIP social science program									
1	SAT-V	.20	.204***	.45***	.20	.221***	.47***	.20	.197***	.44***
2	SAT-V	.23	.025***	.47***	.03	.013***	.46***	.24	.046***	.46***
	Gender			-.16***			.12***			-.22***
3	SAT-V	.23	.000	.47***	.00	.000	.46***	.24	.000	.47***
	Gender			-.16***			.12***			-.21***
	TIP social science			.00			-.02			-.02
4	SAT-V	.23	.002*	.47***	.00	.000	.46***	.24	.001	.47***
	Gender			-.16***			.12***			-.22***
	TIP social science			.03			-.02			.00
	SAT-V X TIP social science			-.05*			.01			-.04
5	SAT-V	.23	.000	.47***	.00	.000	.46***	.24	.000	.47***
	Gender			-.16***			.12***			-.22***
	TIP social science			.06*			-.03			.00
	SAT-V X TIP social science			-.05*			.01			-.04
	Gender X TIP social science			-.03			.01			.00

Note. All models were significant at the .001 level. ELP = English, law, and political science.
* $p < .05$. ** $p < .01$. *** $p < .001$.

whereas females scored higher than males on English. Including all predictors, participation in Duke TIP social science programs in middle school positively predicted the ELP EOC scores. There was a statistically significant interaction effect of SAT-V and participation in Duke TIP social science programs ($\beta = -.05$, $p < .05$). Follow-up analyses were conducted to examine this interaction effect by running hierarchical regressions on ELP using gender and social science TIP program participation for high and low SAT-V groups (see Table 3). The high versus low SAT-V groups were classified using 570 as the criterion (1.09 *SD* above the mean of SAT-V for the overall sample). Results of the follow-up analysis showed that males performed better than females on ELP EOC scores in both high and low SAT-V groups. Participation in the social science Duke TIP program predicted positively and negatively ELP EOC scores for low and high SAT-V groups, respectively. However, neither regression coefficient was statistically significant.

Discussion of Study 1

In this first study, the effects of middle school Duke TIP summer program attendance on high school EOC scores were not large, after controlling for the contributions of SAT score and gender. However, it is noteworthy that a 3-week summer program did show some long-term effects in a few cases. For example, attending Duke TIP math and computer science program was positively associated with the EOC scores in Algebra I. Also, attending Duke TIP social science programs positively predicted EOC scores in ELP. More importantly, the results indicated differentiated effects of participation in Duke TIP summer programs for the high versus low SAT-M or SAT-V groups. A comparison of the standardized coefficients between the high versus low SAT-M and SAT-V groups shows that the participation in Duke TIP summer programs predicted EOC scores more positively for the students with lower SAT-M and SAT-V scores. These interaction effects likely indicate a ceiling effect for high SAT-M and SAT-V groups. That is, these students may have already reached the maximum on the EOC score range, leaving little room for improvement.

Although the results revealed some important effects of attending a Duke TIP summer program, there are some limitations to the findings. First, the statistical power was limited by the small sample sizes in specific subject areas (i.e., limited by the number of TIP students in each subject area). The cell sizes become even smaller when the whole sample was further divided into two groups with high versus low SAT scores. This low statistical power may have limited our ability to detect significant effects. Second, we were not able to match exactly the content of Duke TIP summer courses with the subject areas of the EOC tests. Although we matched them as closely as possible (e.g., separating hard science and living science), the low correspondence between the courses and the tests also may lead to a lack of significant findings. Third, the significant results should be interpreted with caution. It should be noted that the effect sizes for the significant findings were small, indicating small program effects of Duke TIP summer program participation in middle school on high school achievement test scores (i.e., EOC scores). Furthermore, although we strived to control for potential confounds of Duke TIP program participation, such as SAT scores, there may be other potential variables explaining the significant results (e.g., family income, parental support) that were not captured in the present study. Nevertheless, the positive effects of Duke TIP summer programs on TIP students' later academic performance are encouraging. This study also is informative with regard to revealing the differentiated effects of Duke TIP summer programs on subgroups of TIP students (e.g., high vs. low SAT-M or SAT-V groups).

Study 2

Methods

Participants. To follow up and examine students' high school and college academic performance, surveys were sent to both TIP students and Search Only students who qualified in the 1996 and 1997 talent searches and also had North Carolina high school records. At the time of the survey, these students would have been juniors or seniors in college. Instead of using all of the Search Only students in the 1996 and 1997 talent searches, we selected a group of Search Only students who were comparable to the TIP students on gender, ethnicity, and qualification level. Approximately 400 surveys were sent to the TIP students and 600 to the Search Only students. Of those who returned surveys, 92 were TIP students (return rate: 23%) and 184 were Search Only students (return rate: 31%). Students in each group (i.e., TIP group or Search Only group) who responded to the survey in Study 2 did not differ from the rest of the students in their respective group on parental education. However, students who returned the survey had higher overall SAT scores than the rest of the students within each group (TIP group: $F[1, 91] = 5.06$, $p < .05$, partial $\eta^2 = .06$; Search Only group: $F[1, 2642] = 54.10$, $p < .01$; partial $\eta^2 = .02$).

As in Study 1, TIP students who participated in a Duke TIP program only in high school were excluded from the analyses so that the prediction model could reflect our research aim, which was to examine the effects of Duke TIP program participation in middle school on high school advanced course-taking, college major choice, academic achievement, and educational aspiration. Therefore, only students who participated in Duke TIP summer programs in middle school were retained in the data analysis. Our final sample for Study 2 included 68 (36 females) TIP students and 184 (106 females) Search Only students. Based on participants' self-report, the family background of the TIP and Search Only groups was similar.

The TIP and Search Only groups did not differ significantly on their family income ($F[1, 175] = 1.73$, $p = .68$; partial $\eta^2 = .00$). Additionally, the chi-square examinations showed that maternal and paternal occupations of both groups were similar (paternal occupation: Pearson $\chi^2 = 14.06$, $df = 8$, $p = .08$; maternal occupation: Pearson $\chi^2 = 6.06$, $df = 9$, $p = .73$). Paternal education did not differ between these two groups ($F[1, 249] = 2.09$, $p = .15$; partial $\eta^2 = .01$). However, maternal education of the TIP group was higher than that of the Search Only group ($F[1, 249] = 4.16$,

$p = .04$; partial $\eta^2 = .02$). Lastly, both groups of participants lived in similar communities (i.e., urban, suburban, and rural; Pearson $\chi^2 = 1.85$, $df = 2$, $p = .40$).

The majority of the respondents in both groups (83.1% of TIP students and 87.6% of Search Only students) were Caucasian. Although the TIP and Search Only sample pools were matched prior to mailing the surveys, respondents in the two groups used in the analyses had significantly different SAT-M scores ($F[1, 236] = 30.85$, $p < .001$). Therefore, we controlled for SAT-M score in our analyses. For the combined sample, males had higher SAT-M scores than females ($F[1, 236] = 23.78$, $p < .001$). This gender effect did not differ between the TIP and Search Only groups ($F[1, 236] = .70$, $p = .41$).

Survey. The survey was designed similarly to that used by Barnett and Durden (1993). Although it assessed a broad range of variables, for the current study only the information related to high school course-taking, academic achievement (high school and college GPAs), college major, and educational aspirations were used. Unlike in Study 1, the outcome variables in this study were all self-reported.

Coding for Duke TIP program participation. There were four areas of Duke TIP summer programs participation that were initially coded, including math and computer science, science, social science, and humanities. Because we wanted to examine the program effects for math/science oriented classes in particular, and because students often have overlapping interests in these fields, we also developed a math and science code, which included courses from both math and computer science and science. This combination variable allowed us to capture potential effects with a slightly wider net. The program participation variables were dummy coded (0 = *not participated in any summer program*; 1 = *participated in at least one summer program*).

Coding for advanced courses. Advanced Placement (AP) classes were coded into four areas: math, science, math/science, and English. Only one accelerated subject (AS), English, was examined in the chi-square analysis as the cell *N*s in the cross-tabulation were very small for all other accelerated subjects. Similarly, only college-level classes (CLC) in math were examined in the chi-square analysis. However, all courses were included in the ANCOVAs reported in Table 5. All of these above variables were dummy coded (0 = *no advanced class taking in high school*; 1 = *took at least one advanced class*).

Coding of college major. Participants' responses regarding their majors in college were initially coded into 28 categories. Five major categories were further coded on the basis of these 28 categories, specifically math, science, math/science, humanities, and social sciences. Math major included majors in mathematics and computer science. Science major included majors in engineering, physical science, agriculture and natural resources, biological and life sciences, and health professions and allied services. The math/science major included majors in any field mentioned above. Humanities included majors such as art or art history, English or literature, foreign and classical languages, history, philosophy, and religion. Finally, social sciences major included economics, military sciences, political science, psychology, public policy, sociology, and social sciences. Like the program participation and advanced class variables, the majors also were dummy coded (0 = *not majored in that area*; 1 = *majored in that area*). Only the first college major listed was analyzed.

Coding of educational aspiration. Educational aspiration was indicated by three questions about participants' desire to obtain a certain degree (e.g., "Do you intend to earn a doctorate degree?"). Three levels of degrees were included in the questions (i.e., a bachelor degree, a master's degree, and a doctorate degree). Participants responded with either a yes or no (0 = *No*; 1 = *Yes*) for each question.

Analysis plan. Different analytic methods were used in Study 2 to address various research questions. Specifically, chi-square analysis was employed to examine whether participation in Duke TIP programs was related to students' enrollment in advanced courses and majoring in a related field in college. Furthermore, we conducted analyses of covariance (ANCOVA) to examine to what extent Duke TIP program participation was related to the number of advanced courses taken and to high school and college GPAs. Finally, we used chi-square analysis again to examine whether there was a significant association between Duke TIP program participation and students' educational aspiration. A more detailed description of these analyses and the results can be found below.

Results

Associations Between Duke TIP Program Participation and Advanced Course-Taking in High School and Between Duke TIP Program Participation and College Major. Chi-square analysis was employed to examine the association between Duke TIP program participation in middle school and students' high school advanced course-taking. To make the associations theoretically meaningful, only associations of close areas were examined; specifically, (a) the associations between Duke TIP math program participation and advanced math classes and math major; (b) the associations between Duke TIP science program participation and advanced science classes and science major; (c) the associations between Duke TIP math/science program participation and advanced math/science classes and math/science majors; and (d) associations between Duke TIP humanities program participation and advanced English classes and humanities majors.

Results showed that participating in a Duke TIP math program in middle school was significantly associated with students' taking AP math classes in high school ($\chi^2 = 5.67, p = .02$). Eighty-seven percent of the Duke TIP students, as opposed to 62% of the Search Only students, took AP classes in math. Duke TIP math program participation was not related to students' taking of AS or CLC math classes while in high school, nor to their choice of majoring in math in college.

Participating in a Duke TIP science program in middle school was not associated with taking an AP science class, but it was associated with students' college majors in sciences at the .10 significance level ($\chi^2 = 3.46, p = .06$). Forty-two percent (42.3%) of the Duke TIP students who participated in at least one science program majored in science in college, whereas one fourth (25.2%) of the Search Only students majored in science.

When combining the two subjects, Duke TIP math/science program participation was significantly related to students' choice of a math/science college major ($\chi^2 = 5.28, p = .02$), but not related to AP courses in math/science. About half (51.1%) of the TIP students who participated in at least one math or science program at Duke TIP, as opposed to one third (33.2%) of the Search Only students, majored in math or science areas in college.

Duke TIP humanities program participation was not significantly related to students' advanced course-taking in English, nor to their choice of a humanities major in college. While the information regarding advanced course-taking in the social sciences was not available, we were able to obtain social science college major information. There was no significant association between participation in a Duke TIP social science program and students' choice of a social science major in college.

Numbers of AP, AS, and CLC Classes Taken. ANCOVAs were conducted to investigate Duke TIP program participation in middle school and the total number of advanced classes (AP, AS, and CLC) taken in high school. The effects of overall Duke TIP program participation, gender, and the interaction of these two on the total numbers of classes were examined, while controlling for overall SAT scores (the sum of SAT-M and SAT-V). Similar ANCOVAs were then conducted for the numbers of advanced classes taken in different fields using Duke TIP program participation in similar fields as a predictor and controlling for either SAT-M (for math and science classes) or SAT-V (for English classes). Table 5 shows the adjusted mean numbers of advanced course-taking after accounting for SAT. The assumption of homogeneity of regression for these ANCOVAs was checked. This assumption assumes the regression coefficients between the dependent variable and the covariate (i.e., SAT scores) are not significantly different across groups. When this assumption was not met for a certain grouping variable (i.e., gender or Duke TIP status), that variable was then excluded from the ANCOVA.

Specifically, gender was excluded from the ANCOVAs on the total number of college-level classes taken and the total number of college-level math classes taken, and Duke TIP status was excluded from the ANCOVA for the total number of AS math classes taken. Results of the ANCOVAs follow.

As Table 5 shows, TIP students and Search Only students did not differ in their total number of AP, AS, or CLC classes taken, nor was there a gender effect. However, not surprisingly, there were significant positive effects of SAT scores on the number of these classes taken, that is, students with higher SAT scores tended to take more advanced courses.

In the ANCOVAs for advanced math and science classes, SAT-M scores were controlled as a covariate. SAT-M scores explained a significant amount of variance in the number of AP, AS, and college-level math courses taken and AP science classes taken (see Table 6). TIP and Search Only students did not differ in the total numbers of AP, AS, and college-level math classes that they took in high school.

For advanced science classes, there was a significant interaction effect of Duke TIP math and science program participation and gender on the total number of AP science class taking ($F[1, 229] = 5.56, p < .05$). Follow-up analyses showed that the positive effect of Duke TIP math and science program participation only held for males ($F[1, 97] = 5.98, p < .05$). That is, males who participated in Duke TIP math and science programs in middle school took more AP science classes in high school. This program effect was obtained after controlling for the effect of SAT-M scores. Besides the interaction effect, a main effect of gender also was observed on AP and college-level science classes. In comparison to females, males took significantly more AP science classes ($F[1, 229] = 9.68, p < .01$) and college-level science classes ($F[1,235] = 4.80, p < .05$) in high school.

There was a significant and positive overall effect of SAT-V on the total number of AP English classes taken ($F[1,229] = 15.07, p < .001$). However, there was no significant effect of Duke TIP humanities program participation or gender on AP, AS, or college-level English classes.

Table 5

Adjusted Mean Numbers of Advanced Classes Taken and Mean GPAs for TIP and Search Only Groups

		TIP Group		Search Only Group	
		Mean	*SD*	Mean	*SD*
Total Classes					
AP		3.29	0.23	3.35	0.14
	Male	3.49	0.34	3.14	0.21
	Female	3.10	0.30	3.55	0.18
AS		1.51	1.51	1.42	0.21
	Male	1.93	0.52	1.19	0.32
	Female	1.08	0.48	1.65	0.28
CL		0.62	0.20	1.00	0.13
	Male				
	Female				
Math and Science Classes					
AP-Math		0.86	0.11	0.84	0.05
	Male	0.89	0.16	0.83	0.08
	Female	0.84	0.14	0.85	0.07
AS-Math					
	Male				
	Female				
CL-Math		0.09	0.10	0.28	0.05
	Male				
	Female				
AP-Science		0.87	0.11	0.64	0.05
	Male	1.20	0.17	0.70	0.08
	Female	0.53	0.15	0.59	0.07
AS-Science		0.04	0.13	0.18	0.06
	Male	0.10	0.19	0.20	0.09
	Female	-0.02	0.18	0.17	0.08
CL-Science		0.06	0.05	0.06	0.02
	Male	0.13	0.07	0.10	0.03
	Female	-0.00	0.06	0.02	0.03
English Classes					
AP-English		0.47	0.19	0.59	0.05
	Male	0.48	0.30	0.44	0.07
	Female	0.46	0.24	0.74	0.06
AS-English		0.11	0.29	0.31	0.07
	Male	0.11	0.43	0.28	0.11
	Female	0.10	0.37	0.34	0.09
CL-English		0.00	0.06	0.03	0.01
	Male	0.01	0.08	0.03	0.02
	Female	0.00	0.07	0.02	0.02
High School GPA		3.80	0.07	4.03	0.04
	Male	3.72	0.10	3.93	0.06
	Female	4.12	0.05	4.12	0.05
College GPA		3.37	0.07	3.48	0.04
	Male	3.37	0.10	3.42	0.06
	Female	3.38	0.09	3.53	0.05
Major GPA		3.49	0.07	3.58	0.04
	Male	3.48	0.10	3.55	0.06
	Female	3.51	0.10	3.61	0.05

Note. **Means presented in this table were obtained after accounting for the covariate, SAT scores (math, verbal, or overall scores). Corresponding to Table 6, adjusted means were not obtained when the homogeneity of regression assumption was not met in the ANCOVAs.**

Table 6

F Values and Effect Sizes for ANCOVAs on the Numbers of Advanced Courses Taken

	AP	ES	AS	ES	CLC	ES
Total number of classes						
SAT total	6.80 (1, 216)*	.03	14.71(1, 231)***	.06	14.65 (1, 154)***	.09
Gender	0.00 (1, 216)	.00	0.21 (1, 231)	.00		
Duke TIP participation (overall)	0.04 (1, 216)	.00	0.04 (1, 231)	.00	2.61 (1, 154)	.02
Gender X Duke TIP participation (overall)	2.33 (1, 216)	.01	2.55 (1, 231)	.01		
Math classes						
SAT-M	35.45 (1, 235)***	.13	32.70 (1, 236)***	.12	33.88 (1, 239)***	.12
Gender	0.02 (1, 235)	.00	0.04 (1, 236)	.00		
Duke TIP math and science	0.04 (1, 235)	.00			2.78 (1, 239)	.01
Gender X Duke TIP math and science	0.12 (1, 235)	.00				
Science classes						
SAT-M	5.86 (1, 229)*	.03	2.19 (1, 234)	.01	0.60 (1, 235)	.00
Gender	9.68 (1, 229)**	.04	0.28 (1, 234)	.00	4.80 (1, 235)*	.02
Duke TIP math and science	3.13 (1, 229)⁺	.01	0.98 (1, 234)	.00	0.00 (1, 235)	.00
Gender X Duke TIP math and science	5.56 (1, 229)*	.02	0.11 (1, 234)	.00	0.18 (1, 235)	.00
English classes						
SAT-V	15.07 (1, 229)***	.06	1.64 (1, 233)	.01	0.27 (1, 234)	.00
Gender	0.50 (1, 229)	.00	0.01 (1, 233)	.00	0.01 (1, 234)	.00
Duke TIP humanities	0.37 (1, 229)	.00	0.47 (1, 233)	.00	0.17 (1, 234)	.00
Gender X Duke TIP humanities	0.67 (1, 229)	.00	0.01 (1, 233)	.00	0.00 (1, 234)	.00

Note. Effect sizes (*ES*) are partial η^2. AP = Advanced Placement; AS = accelerated subject; CLC = college-level course. Only TIP status was examined for CLC total and CLC math classes as the homogeneity of regression assumption was not met for gender in these two ANCOVAs; for a similar rationale, only gender was examined in the ANCOVA for AS math classes. * $p < .05$. ** $p < .01$. *** $p < .001$. ⁺ $p < .10$.

High School, College, and Major GPAs. ANCOVAs were conducted to examine the effects of overall Duke TIP program participation, gender, and the interaction of these two on students' high school and college grade point averages (GPAs). The adjusted means of GPA by gender and by group are shown in Table 5, respectively. Again, overall SAT scores were controlled as covariate in these analyses. ANCOVA results showed that SAT scores were significantly associated with high school GPA ($F[1, 208] = 8.17, p < .01$; partial $\eta^2 = .04$). Controlling for the effect of SAT scores, there were statistically significant main effects of gender and Duke TIP program participation on high school GPA. Female students reported higher high school GPAs than male students ($F[1,208] = 4.72, p < .05$; partial $\eta^2 = .02$). Search Only students reported higher high school GPA than students who participated in Duke TIP summer programs ($F[1,208] = 7.71, p < .01$; partial $\eta^2 = .04$).

For college and major GPAs, there were no statistically significant main effects of gender or Duke TIP program participation, or the interaction effect between the two. However, SAT scores were still significantly associated with college GPA ($F[1, 221] = 10.87, p < .01$; partial $\eta^2 = .05$) and major GPA ($F[1, 201] = 4.11, p < .05$; partial $\eta^2 = .02$).

Educational Aspirations. Chi-square analyses were conducted to examine the association between Duke TIP summer program participation and students' educational aspirations. There was no association between Duke TIP program participation and students' aspiration for a bachelor's or a master's degree. However, a significantly higher percentage of TIP students (52.2%) than Search Only students (33.5%) reported intentions to earn a doctorate degree ($\chi^2 = 7.25, p < .01$; odds ratio = 2.17).

Discussion of Study 2

For this study, we hypothesized that Duke TIP program participation may influence students' later choices of subject areas to pursue, such as taking advanced classes in high school and selecting college majors, as well as their academic achievement and educational aspiration as reported by the students. We found that students who participated in a Duke TIP math program in middle school did indeed take more AP math courses in high school, but there were no effects for other types of advanced math classes or for any other subjects. Additionally, compared to Search Only students, students who took a math/science course at Duke TIP were more likely to major in math/science in college. SAT scores were controlled in these analyses.

The magnitudes of the effect of Duke TIP summer program participation on the number of advanced courses taken were quite small. There were generally no effects of Duke TIP participation on the number of advanced courses that students reported taking in high school. However, the interaction between gender and Duke TIP science program participation seems to suggest that whether there is a program effect on advanced course-taking in high school may depend on the youth's gender. For males, those who participated in Duke TIP science programs also took more AP science courses in high school than Search Only males, but such a program effect did not hold for females.

Interestingly, students who participated in a Duke TIP program reported lower high school GPAs than Search Only students after accounting for the effect of SAT scores. The usual explanation that more challenging courses may lead to lower grades may not hold in this case because there were no group differences in numbers of advanced courses taken. However, advanced classes may still differ in difficulty level. Therefore, whether the difficulty level of courses taken by Duke TIP and Search Only students plays a role in their GPA requires further research. On the other hand, unlike other summer residential programs for the academically gifted, Duke TIP deliberately does not grade students. Such an ideology that focuses on learning and mastery of material rather than performance on exams might lead Duke TIP students to place less emphasis on grades.

Finally, we found that more Duke TIP students than Search Only students aspired to a higher level of degree, a doctorate degree. This may suggest that in-depth exposure to a subject area during a summer program early on ignites a long-term curiosity that leads to the pursuit of a life of the mind. The university campus setting where Duke TIP summer program students reside gives students the opportunity to observe and encounter the campus life of academically achieving groups, such as undergraduate students, graduate students, and professors. Such an academically inspiring campus environment may cultivate students' educational aspirations.

It would have been interesting to examine whether the effect of Duke TIP program on choice of college major works through advanced course-taking in high school (i.e., a path analysis). To examine the latter hypothesis, however, significant associations need be established between Duke TIP program participation and students' taking of advanced courses in high school and between Duke TIP program participation and students' major fields of study in college. However, due to the categorical nature of the coding for Duke TIP participation and college major, a path analysis was not possible; we were only able to use chi-square analysis techniques to examine the associations. Despite this limitation, we did find effects of Duke TIP participation on later school choices, demonstrating the significant impact that such a program can have in the lives of gifted students.

Overall Conclusion

In this set of studies, we employed a quasi-experimental design and examined the long-term effects of Duke TIP summer programs for two cohorts of students (1996 and 1997). Students who participated in the Duke TIP summer program in middle school were compared with those who qualified for, but did not participate in, any Duke TIP programs. Study 1 compared TIP students with Search Only students on the high school level state standardized test scores (EOC scores). Study 2 examined a subsample of North Carolina students from the 1996 and 1997 talent search cohorts who were either Duke TIP attendees or nonattendees, but this time used a self-report survey of the students' achievement when they were juniors and seniors in college.

In both studies, some small positive effects of Duke TIP summer programs were found on later academic achievement and achievement choices using both standardized objective measures (the EOC scores) and self-reports of high school and college academic experiences. These results are suggestive and encouraging. Anecdotally, we have heard from many former Duke TIP participants how much Duke TIP has affected their lives, and it is noteworthy that we are now able to begin to empirically document some of these effects.

The effect sizes of the program effect were small in general, indicating weak associations between participation in Duke TIP summer programs in middle school and later academic performance. However, caution should be used when interpreting the findings. The lengthy time lags between the Duke TIP program participation in middle school and students' performances in high school and college (between 1 and 9 years) may reduce our ability to observe positive program effects. Additionally, we do not have full information regarding whether the Search Only students had participated in academic enrichment programs other than Duke TIP programs.

Among the 176 Search Only students who responded to the survey, about 18% (32 students) indicated that participation in other academic enrichment programs was one of the reasons for not coming to Duke TIP summer programs. Understandably, Search Only students' participation in other academic enrichment programs would have reduced the achievement differences between them and Duke TIP students. Furthermore, we have small and unequal sample sizes for the groups in both studies, especially in the first study. The representativeness of the samples would have been greatly improved if we had been able to include more Duke TIP students. The group differences also are likely to be underestimated given the unequal sample sizes between the TIP group and the Search Only group (Howell, 2002). In other words, with an even or balanced sample size across groups, we may have been able to observe larger program effects.

Lastly, like in many other studies with a quasi-experimental design, potential selection effects may occur and thus limit our ability to draw causal inferences. To the extent possible, we accounted for the group differences that might explain the differences in the outcome variables. For example, in all of the mean comparisons and regressions, we controlled for SAT scores. We also checked the family background (e.g., parental education, family income) of the two comparison groups in each study with available information. However, there may be other group differences (e.g., parental support) that may confound with Duke TIP program participation and explain the results, yet were not captured in the current studies. Future research should address these potential group differences and strengthen the comparisons.

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