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Life in the Fast Lane: Effects of Early Grade Acceleration on High School and College Outcomes

Katie Larsen McClarty[1]

Abstract

Research has repeatedly demonstrated the positive effects of acceleration for gifted and talented students. This study expands the literature by not only evaluating the impact of early grade skipping on high school and college outcomes but also examining the role of postacceleration opportunities on subsequent performance. Using a representative national sample, accelerated students were compared with older grade-level peers who had similar academic and demographic backgrounds. Results suggest that, on average, accelerated students consistently and significantly outperformed their nonaccelerated peers, both in high school and in college. Furthermore, postacceleration educational opportunities provided additional benefit; students who skipped a grade and also participated in challenging academic programs (e.g., Advanced Placement, high-ability instructional groups) demonstrated particularly high achievement. Results suggest that gifted learners profit most when acceleration is coupled with additional opportunities for advanced study.

Keywords

acceleration, gifted, grade skipping, college outcomes, longitudinal analysis

The 2012 Programme for International Student Assessment results suggest the United States continues to lag behind most other developed nations, not only in terms of overall academic achievement but also in terms of the percentage of students identified as high performing (Organisation for Economic Co-operation and Development, 2013). The small percentage of U.S. 15-year-olds scoring at the top levels on Programme for International Student Assessment (8% in reading literacy, 9% in mathematics literacy, and 7% in science literacy) is noteworthy because it represents a decline relative to the performance of fourth- and eighth-grade students (17%, 13%, and 15% scoring in the top categories for international reading, mathematics, and science assessments, respectively; Mullis, Martin, Foy, & Arora, 2012; Mullis, Martin, Foy, & Drucker, 2012; Mullis, Martin, Foy, & Stanco, 2012). This decline suggests the more time talented students spend in U.S. schools, the lower their performance on international assessments. In short, the United States has ample room to improve education for the most talented learners.

Downward trends for gifted learners are concerning because these students could have bright futures as national leaders, entrepreneurs, inventors, and influencers. For example, 44% of high-ability students recognized before the age of 13 years went on to earn a doctorate degree, compared with a national prevalence of only 2% (Kell, Lubinski, & Benbow, 2013). These young, talented students often go on to make substantial creative and intellectual contributions in their respective fields. On average, they produced 5.3 creative written works, 20.6 fine arts accomplishments, 6.6 STEM (science, technology, engineering, and mathematics) publications, seven software development contributions or patents, and nearly a million dollars in grant funding per person—all before the age of 40 years. Through these contributions, top-performing students can spur innovation and meaningfully benefit social progress.

For such potential to be realized, however, educators and policy makers must nurture gifted students' talents and provide appropriate instructional supports. One promising approach for facilitating talent development is acceleration. Acceleration generally refers to students progressing through educational programs at faster rates or younger ages than typical (Pressey, 1949). This study evaluates the impact of early acceleration on subsequent academic outcomes and investigates whether additional educational opportunities can provide additional impact.

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Effects of Acceleration

Studies of acceleration effects date back to the 1920s, although acceleration for highly able learners was documented as early as 1862 (Rogers, 1992). Early research on acceleration investigated its impacts on students' academic achievement and social–emotional development; studies today generally have the same two foci. Meta-analyses summarizing nearly 80 years of research reveal a remarkably consistent pattern: accelerated students outperform comparable nonaccelerated peers on both K-12 and postsecondary achievement outcomes (Kulik & Kulik, 1984; Rogers, 1992; Steenburgen-Hu & Moon, 2011). The effects of acceleration on social–emotional outcomes are weaker, but research typically suggests no adverse impact (Kent, 1992; Kulik & Kulik, 1984; Rogers, 1992; Steenburgen-Hu & Moon, 2011).

Although most acceleration studies find generally positive effects associated with talented students skipping ahead, homing in on more nuanced effects requires considering different types of acceleration and constructing an appropriate comparison group. Comparison groups are constructed in observational studies of acceleration because randomized experimental designs are rarely possible; it does not make sense to hold back students who are willing and able to accelerate. Instead, nonexperimental research is more common, whereby researchers compare accelerated students with one of two different types of controls. Each control addresses a separate research question.

The first type of control group is same-age, same-ability, nonaccelerated peers. In studies using these controls, researchers implicitly examine whether acceleration leads to greater student achievement than would have occurred otherwise. Results demonstrate that accelerated students score higher than same-age peers on standardized aptitude and achievement tests in K-12 settings, with a median effect size of 0.80 (Kulik, 2004). In college, accelerated students tend to earn higher grades, complete their degrees more quickly, and earn more honors at graduation (Janos, 1987; Park, Lubinski, & Benbow, 2013).

The second type of control group is older classmates. Studies employing this control pose a slightly different question, that is, whether accelerated students can keep up with their older peers. Results show accelerated students perform as well as, or better than, similar older peers (Kulik, 2004; Kulik & Kulik, 1984; Steenburgen-Hu & Moon, 2011). For example, early college entrants had grade point averages (GPAs) that were nearly half a point higher than college freshman with similar precollege aptitude, even though the accelerated students averaged 4 years younger (Janos & Robinson, 1985). In fact, college grades for early entrants were most similar to those of National Merit Scholars, with both earning GPAs just over 3.4.

The studies noted above summarize effects across a variety of acceleration approaches. Although nearly all effects were positive, the magnitude of effects varied substantially across acceleration contexts. This variation suggests "factors other than acceleration play a role in determining study outcome" (Kulik & Kulik, 1984, p. 418). As such, researchers have begun to investigate the factors that may make acceleration more or less effective.

One factor that has received focused attention is the type of accelerative program. In her synthesis of 314 studies, Rogers (1992) showed positive achievement effects for grade-based acceleration (where students complete their K-12 education in fewer years than typical), subject-based acceleration (where students are advanced in a particular content area), and college-based acceleration (where students enroll early in college or earn college credit while in high school). Rogers also found positive outcomes associated with specific interventions such as early entrance, grade skipping, and grade telescoping. A more recent meta-analysis supported these conclusions, reporting positive effects for both grade-based and subject-based acceleration with no significant differences between the two (Steenburgen-Hu & Moon, 2011).

Other studies have examined grade level at the start of acceleration, period of acceleration, subject area of acceleration, quality of the outcome measures, research design, study duration, publication source, publication year, sample size, and statistical analyses employed. None of these factors moderated the impact of acceleration on academic achievement (Kulik & Kulik, 1984; Steenburgen-Hu & Moon, 2011). Two other study facets, however, did seem to affect acceleration outcomes. Estimated acceleration effects were larger when accelerated students were compared with a same-age control group rather than an older control group (Kulik & Kulik, 1984) and when the sample of accelerated students was predominantly male (Steenburgen-Hu & Moon, 2011).

Gender differences have also been found in other studies. For example, accelerated men entered professional fields sooner and were rated highly successful in their careers earlier than nonaccelerated men (Janos, 1987). Accelerated women did not see the same career advantages, although the data were collected in 1940 when the number of women entering professional careers was comparatively small. More recent research suggests some gender differences persist. Specifically, grade skipping was more likely to enhance STEM career outcomes for men than women (Park et al., 2013). Acceleration still provided benefits for women, but women tended to pursue advanced degrees in the fields of law and medicine rather than STEM. In sum, accelerated men and women both had impressive educational and career outcomes—but in different domains.

Existing research has explored some conditions under which acceleration is most effective, typically focusing on policy at the point of acceleration (e.g., type of acceleration, age when accelerated) or the characteristics of the accelerated (e.g., gender). Much less common are systematic analyses of the additional impact of postacceleration educational opportunities. Educational opportunities for accelerated students include (but are not limited to) Advanced Placement courses and high-ability instructional groups. Limited research on the topic suggests these opportunities can enhance the talent development process. For example, Brody, Assouline, and Stanley (1990) suggest that although early entrants to college generally perform better than typical undergraduates, the effects were largest for those accelerated students who had taken Advanced Placement courses in high school. It is therefore possible that the impact of acceleration is amplified by opportunities for advanced study. Unfortunately, evidence in this area is thin. This article attempts to address that gap in the research literature.

The present study evaluates not only the effects of a specific form of acceleration—grade skipping—but also the effects of subsequent educational opportunities. Using a nationally representative data set spanning multiple decades, students who skipped at least one grade prior to eighth grade were compared with their older eighth-grade classmates on later high school and college achievement outcomes. It is important to note that most prior research has examined students identified through talent searches or programs at specific institutions—gifted students who by virtue of identification have already received additional educational opportunities. The national data set, on the other hand, includes accelerated students who did *not* participate in additional talent development programs, so it is uniquely suited to answering questions about additional impacts of educational opportunities. This investigation of grade skipping and educational opportunities was guided by two primary research questions:

Research Question 1: How do students who have skipped a grade perform academically, relative to older, comparable grade-level peers?

Research Question 2: What additional impact might postacceleration opportunities provide for students who skipped a grade?

Method

Data

This analysis uses the National Educational Longitudinal Study of 1988 (NELS; National Center for Education Statistics, 2000), which followed a nationally representative cohort of U.S. students from eighth grade, through high school, and at multiple points following high school exit. Specifically, NELS sampled students in 1988 when they were in Grade 8. Additional data collections took place in 1990 (Grade 10), 1992 (Grade 12), 1994 (2 years after high school), and 2000 (8 years after high school). For each data collection wave, students answered questions about their home, school, and work experiences and aspirations. Students completed standardized achievement tests in 1988, 1990, and 1992 and provided high school and college transcripts. Parents, teachers, and school administrators also responded to surveys, providing more detail about home and school environments.

Identifying Accelerated Students

This study focuses on the acceleration practice of grade skipping. Using NELS data, there are two approaches for identifying students who have skipped a grade. The first is based on parent responses to survey questions. Of the 12,144 students in the NELS data set, 213 skipped a grade at some point according to parents' reports. Because it is possible, however, for a student to be retained 1 year and skip a grade in a subsequent year (to rejoin same-age peers), cases were eliminated if parents reported the student had ever been retained. The remaining 145 students could be considered grade skippers using the *survey response* approach.

The second identification approach uses student age. An age-based approach can be useful if, for instance, parents of students that entered kindergarten early did not report their child had skipped a grade (although in fact, he had). Students who have skipped one or more grades should be younger than their grade-level peers and can be identified by date of birth. This age-based identification approach has been used previously with the NELS data (Wells, Lohman, & Marron, 2009). Following Wells et al. (2009), students were identified as grade skippers if their birth date was after January 1, 1975. Most NELS eighth-grade students would have been 5 years old by the typical kindergarten cutoff date of August or September 1979 (and therefore born before August or September 1974). To account for areas where the kindergarten cutoff date might be later, *young for grade* accelerated students were conservatively defined as those who were born after January 1, 1975, and therefore turned 5 years after January 1, 1980—4 months later than typical cutoff dates. There were 108 students identified using this approach, representing about 1% of the total NELS population.

Only 51 students were identified under both the *survey response* and *young for grade* methods. Students identified by the *survey response* approach were between 13 and 17 years old in eighth grade, with an average age of 13.9 years. In fact, nearly 20% of the students whose parents indicated they had skipped a grade were 15 years or older in eighth grade (which is unusually old for an eighth-grade student who has never been retained). In contrast, students identified using the *young for grade* approach were between 9 and 13 years old in eighth grade, with a mean of 12.7. Consequently, the *young for grade* approach was used for identification rather than relying on survey responses.

Matching Procedure

Once accelerated students were identified, the next step was to identify a matched set of older, nonaccelerated eighth-grade peers from the NELS sample. Accelerated students were matched with nonaccelerated students of the same gender, race, and socioeconomic status (SES) quartile,[1] as well as similar eighth-grade achievement. Because NELS does not contain any measures of general cognitive ability, a proxy measure was created based on four NELS-administered standardized achievement tests in reading, mathematics, science, and history. Each test was scaled to have a mean of 50 and standard deviation of 10. Principal components extraction (Tabachnick & Fidell, 2007) was used to create a single achievement composite for each student based on the four standardized test scores. The first principal component accounted for 78% of the variance in eighth-grade test scores and forms the basis of the achievement composite. Given that the four achievement scores were highly correlated and they loaded nearly equally on the achievement composite, the composite is preferred over multiple subject-specific assessments as a reasonable ability proxy.[2] In addition, the predicted outcomes were not subject specific, so a general measure seems appropriate. Three accelerated students missing gender, race, SES, or achievement information were deleted, leaving 105 accelerated students eligible for matching.

Each student from the accelerated group was then matched to students from the nonaccelerated group of the same gender, race, SES quartile, and achievement level through Coarsened Exact Matching (CEM; Iacus, King, & Porro, 2011). There are three steps to CEM. In the first step, continuous variables are coarsened so that a match can be found for each student. Therefore, the combined sample of accelerated and nonaccelerated students was divided into 48 achievement-level groups defined by equal intervals on the achievement composite−0.1 standard deviations. Gender, race, and SES quartile were already categorical.[3] The second step is to apply exact matching to each stratum, so each accelerated student was matched to nonaccelerated students with the same gender, race, SES, and achievement-level grouping. In the third step, strata with only control units (i.e., nonaccelerated) are discarded, strata with both control and treated (i.e., accelerated) units are retained, and strata with only treated units can either be discarded or matched control units can be created using extrapolated values. Using the matching variables and coarsening procedures defined above, all accelerated students were matched to at least one comparable nonaccelerated student.[4]

When conducting subsequent analyses of differences between the matched groups, weights were applied to the nonaccelerated students in each gender/race/SES/achievement stratum so that the characteristics of the accelerated group and matched nonaccelerated group would be proportionally equivalent. The weights also created equivalent numbers of students in each condition because there was a large imbalance between the number of accelerated and nonaccelerated students; accelerated students comprised approximately 1% of the total sample. The weights (W_s) were calculated via Equation 1:

$$W_s = \frac{N_A^s}{N_N^s} \tag{1}$$

where N_A^s is the number of accelerated students in stratum s, and N_N^s is the number of matched nonaccelerated students in stratum s ($s = 1, \ldots, S$). Each accelerated student was assigned a weight of 1, and each nonaccelerated student was assigned a weight W_s. Therefore, the sum of the weights for the nonaccelerated students is equal to the sample size of accelerated students (i.e., 105). All subsequent analyses comparing the two groups use these weights.

Outcome Measures

High School Measures. The high school outcome measures included Preliminary SAT/National Merit Qualifying Test (PSAT/NMQT) verbal and mathematics scores; SAT verbal and mathematics scores; ACT composite, English, reading, mathematics, and science reasoning scores; cumulative high school GPA; and college aspirations.

The PSAT/NMQT is a multiple-choice assessment of critical reading and mathematics typically taken by students in 10th or 11th grade.[5] It assesses whether students are on track to college readiness, and it qualifies students for the National Merit Scholarship program. Scores on each section range from 20 to 80. Like the PSAT/NMQT, the SAT measures critical reading and mathematics. It is typically taken by students in 11th or 12th grade. Scores range from 200 to 800 on each section and are used for college admissions. The ACT is also used for college admissions. It consists of four multiple-choice assessment sections: English, reading, mathematics, and science reasoning.[6] Scores on each section range from 1 to 36, and the four section scores are averaged to create the ACT composite. High school GPAs were calculated based on transcript data and converted (when necessary) to a scale ranging from 0.0 to 4.0.

Students reported their college aspirations in Grades 8 and 10. In eighth grade, students reported how far they thought they would get in school. Answer options included: won't finish high school; will finish high school; vocational, trade, or business school; will attend college; will finish college; or higher school after college. In 10th grade, students again noted how far they thought they would go in school. This time answer options were: less than high school graduation, high school graduation only, less than 2 years of trade school, more than 2 years of trade school, less than 2 years of college, more than 2 years of college, finished college, master's degree, and PhD or MD.

College Measures. College outcome measures included the selectivity of the student's first higher education institution, first-year college GPA, second-year college GPA, cumulative undergraduate GPA, and degree attainment.

College selectivity was measured by the *Barron's Profiles of American Colleges*. Selectivity was based on the first true institution each student attended. The first true institution excluded institutions students attended only prior to high school graduation, institutions attended only during the summer between high school graduation and the start of the fall college semester, and institutions with "false starts" where students enrolled and withdrew from a course within the same semester without obtaining any college credits. Selectivity categories were open door, nonselective, selective, or highly selective.

GPA was calculated via college transcript data for students' entire undergraduate education as well as their first and second years of college. All grades were measured on a scale from 0.0 to 4.0. In addition to college grades, students reported all degrees they had earned by the end of the study (8 years after high school exit). Students were then classified into categories based on highest degree earned: less than a bachelor's, bachelor's, master's, and doctorate.

Educational Context Variables

The NELS surveys also provide information about student participation in specific educational opportunities, all of which occurred after the student had skipped a grade. The following postacceleration educational opportunities were considered: participation in advanced, enriched, or accelerated courses in eighth grade; grouping with high-ability eighth-grade peers; completing Advanced Placement courses during high school; and taking Advanced Placement exams.

Students reported whether they were enrolled in advanced, enriched, or accelerated eighth-grade courses in each of four content areas: English, mathematics, science, and social studies. The proportion of advanced courses was calculated for each student (e.g., 0 indicated students enrolled in no advanced courses, 1 indicated students enrolled in advanced courses in every content area, 0.5 indicated students enrolled in advanced courses for half their subjects, and so on). A similar approach was used for students' ability grouping. Students reported what ability group they were placed in for English, mathematics, science, and social studies courses in eighth grade. Students grouped with high-ability peers were compared with other students, which included those in the middle- or low-ability group as well as those where no ability grouping was implemented. The proportion of high-ability groupings for each student was calculated, with 1 indicating high-ability group for all four content areas, 0 indicating high-ability group for no content areas, and so on.

At the end of high school, students reported whether they had ever been in an Advanced Placement program.[7] Students reported only program participation, not how many Advanced Placement courses they had taken. Therefore, students who had taken one course would be considered the same as students who had taken five. Advanced Placement exam scores, however, were reported on high school and college transcripts, so it was possible to calculate the number of exams each student completed. The number of Advanced Placement exam scores was included in the analysis as a lower bound estimate for the number of Advanced Placement courses the student took.

Analysis Approach

To address the first research question regarding the effects of grade skipping, accelerated students' high school and college outcomes were compared with those of matched nonaccelerated students. Mean differences between accelerated and matched nonaccelerated students on PSAT, SAT, ACT, high school GPA, and college GPA measures were assessed via t tests. Logistic regression was used to evaluate the effects of acceleration on college aspirations, selectivity of enrolled college institution, and highest level of degree attainment. For each analysis, student responses were weighted according to the CEM procedure described previously. Weighting was implemented via the "weight" command in SAS version 9.2 (SAS Institute, Cary, NC).

To address the second research question about the additional impact of educational opportunities, analyses were split into two phases. The first phase evaluated how grade skipping affected students' likelihood of participating in various educational opportunities using linear regression (for continuous outcomes) and logistic regression (for binary outcomes). Because the analyses included both accelerated and nonaccelerated students, weighting was applied to compare similar groups. The second phase evaluated how participation in the postacceleration opportunities affected achievement for accelerated students. Correlations summarized the relationships between achievement outcomes and advanced course enrollment, being grouped with high-ability peers, and the number of Advanced Placement exams. The impact of participating in Advanced Placement was assessed via t tests.

Results

Complete and Matched Samples

Demographics of the accelerated NELS sample, the nonaccelerated NELS sample, and the matched, nonaccelerated sample are summarized in Table 1. In general, students who were accelerated were more likely than nonaccelerated students to be female, higher performing, and from more advantaged socioeconomic backgrounds. On average, accelerated students scored half a standard deviation higher than typical nonaccelerated eighth graders on the NELS reading, mathematics, science, and history assessments. In addition, more accelerated students took advanced courses, were grouped with high-ability students, participated in Advanced Placement programs, and took Advanced Placement exams.

Matching, however, dramatically improves balance (i.e., similarity in demographics and achievement) across the accelerated and nonaccelerated groups.[8] Postmatching, the

Table 1. Summary of Accelerated, Nonaccelerated, and Matched Groups.

	Nonaccelerated	Young for grade	Matched nonaccelerated peers[a]
	Matching		
N	12,036	105	105
Male	47%	41%	41%
Minority	21.6%	21.9%	21.9%
Lowest SES quartile	24.9%	11.4%	11.4%
Second SES quartile	25.0%	17.1%	17.1%
Third SES quartile	25.0%	25.7%	25.7%
Highest SES quartile	25.1%	45.7%	45.7%
Standardized reading test	51.4	56.4	56.1
Standardized math test	51.6	58.1	56.8
Standardized science test	51.3	55.5	56.1
Standardized history test	51.2	55.1	56.0
	Nonmatching		
Age	14.4	12.7	14.3
Advanced classes[b]	32%	44%	35%
High-ability group[b]	28%	41%	35%
Advanced Placement courses	39%	61%	52%
Number of Advanced Placement exams taken	0.13	0.52	0.35

Note. SES = socioeconomic status.
[a]Values are reported after weighting. There were 2,329 students in the matched set without weighting.
[b]Represents the average percent of advanced reading, math, science, and social studies courses a student takes (or average percent of those courses where a student is placed in a high-ability instructional group).

accelerated student group was identical to the nonaccelerated group on demographic variables (gender, race, and SES). Because students were matched based on an achievement composite and not individual test scores in each subject, there were minor differences in subject-level test scores; however, the largest discrepancy was about a tenth of a standard deviation. Similarities across the accelerated and nonaccelerated groups indicate good balance across matching covariates.

Effects of Acceleration

Accelerated students' high school and college outcomes were compared with those of their older, nonaccelerated peers. Results are summarized in Table 2. In general, accelerated students outperformed comparable nonaccelerated peers. More specifically, accelerated students scored significantly higher on the mathematics sections of both PSAT/NMQT and SAT and on most ACT measures including English, mathematics, science reasoning, and the composite score. Additionally, accelerated students (M = 3.08) earned higher grades in high school than their nonaccelerated peers (M = 2.94). The only exceptions to this pattern relate to verbal sections of the PSAT/NMQT and SAT and the reading section of the ACT. In these cases, accelerated students scored higher but the differences were not statistically significant. The sample sizes for these analyses were small, however, providing enough power to detect only fairly large differences between groups. It is possible that differences on the verbal and reading sections are smaller and need a larger sample size to be detected. As evidenced in the last column of Table 2, the confidence intervals around the effect sizes are rather large.

In terms of college aspirations, small differences emerged between the accelerated and nonaccelerated groups. In eighth grade, 36% of the accelerated students planned to earn only a bachelor's degree, while 50% thought they would continue to graduate education. In contrast, 44% of nonaccelerated students planned to earn only a bachelor's degree, and only 35% planned to pursue graduate education. In other words, accelerated students were 1.7 times more likely to aspire toward a graduate degree in eighth grade (p = .07). By 10th grade, accelerated and nonaccelerated students had similar aspirations for pursuing graduate education.

Accelerated and nonaccelerated students were admitted to similarly selective colleges. Grade skipping did not significantly influence a student's likelihood of enrolling in a highly selective institution; 16% of the accelerated students compared with 11% of nonaccelerated students enrolled in a highly selective college. Once at college, however, accelerated students

Table 2. High School and College Outcomes for Accelerated Students and Matched Nonaccelerated Peers.

High school outcomes	Mean difference, accelerated − nonaccelerated (*SE*)	Accelerated, *n*	Matched, *n*	Effect size (95% CI)
PSAT-V	0.89 (0.72)	42	988	0.26 (−0.04, 0.57)
PSAT-M	1.63* (0.81)	42	990	0.43 (0.13, 0.74)
SAT-V	6.9 (7.88)	49	923	0.18 (−0.10, 0.47)
SAT-M	32.2* (8.69)	49	923	0.77 (0.48, 1.06)
ACT Composite	1.23* (0.37)	22	767	0.91 (0.47, 1.33)
ACT English	1.02* (0.41)	21	751	0.69 (0.25, 1.12)
ACT Reading	0.52 (0.50)	21	751	0.29 (−0.14, 0.73)
ACT Math	1.23* (0.43)	21	751	0.80 (0.37, 1.24)
ACT Science	1.32* (0.38)	21	749	0.96 (0.53, 1.40)
High School GPA	0.14* (0.04)	69	1,604	0.64 (0.40, 0.88)
College aspirations	Estimate (*SE*)	Accelerated, *n*	Matched, *n*	Odds ratio (95% CI)
8th Grade—Finish college vs. continue on	0.55 (0.31)	105	2,323	1.73 (0.95, 3.16)
10th grade—Finish college vs. master's degree	0.21 (0.39)	98	2,248	1.23 (0.57, 2.67)
10th grade—Finish college vs. PhD, MD.	0.54 (0.38)	98	2,248	1.71 (0.81, 3.60)
College selectivity	Estimate (*SE*)	Accelerated, *n*	Matched, *n*	Odds ratio (95% CI)
Highly selective vs. nonselective	0.40 (0.48)	88	1,906	1.50 (0.58, 3.86)
College outcomes	Mean difference, accelerated − nonaccelerated (*SE*)	Accelerated, *n*	Matched, *n*	Effect size (95% CI)
First-year GPA	−0.02 (0.04)	82	1,831	−0.10 (−0.31, 0.13)
Second-year GPA	0.07* (0.03)	87	1,867	0.33 (0.10, 0.53)
Undergraduate GPA	0.16* (0.03)	91	1,936	0.77 (0.56, 0.98)
Degree attainment	Estimate (*SE*)	Accelerated, *n*	Matched, *n*	Odds ratio (95% CI)
Bachelor's or higher	0.46 (0.30)	96	2,039	1.59 (0.88, 2.87)
Master's or higher	−0.03 (0.52)	96	2,039	0.97 (0.35, 2.71)
Doctorate	−0.21 (1.36)	96	2,039	0.81 (0.06, 11.80)

Note. PSAT-V = preliminary SAT-Verbal; PSAT-M = preliminary SAT-Math; SAT-V = SAT-Verbal; SAT-M = SAT-Math; GPA = grade point average; CI = confidence interval.
*Denotes statistical significance ($p < .05$).

earned higher grades in their second year and overall. For example, grade skippers ($M = 3.01$) finished college with significantly higher GPAs than nonaccelerated peers ($M = 2.84$).

Finally, accelerated and nonaccelerated students had small differences in their rate of degree completion. Sixty-eight percent of accelerated students earned at least a bachelor's degree compared with 57% of nonaccelerated students ($p = .12$). There were no differences in the rate of graduate degree attainment. Specifically, master's degree rates were similar across accelerated (8.3%) and nonaccelerated (8.6%) groups, and approximately 1% of each group earned a doctorate within 8 years of high school completion.

In summary, students accelerated prior to eighth grade performed better than their older, matched peers on the vast majority of high school and college outcome measures. Even when differences were not statistically significant, most trends favored accelerated students.

Effects of Educational Opportunities

Effect of Skipping on Educational Opportunities. Students who skip ahead may also be more likely to take advantage of additional challenging educational opportunities. Indeed, there was some evidence to support this. When compared with similar eighth-grade peers who did not skip, accelerated students were more likely to be enrolled in advanced, enriched, or accelerated eighth-grade courses ($B = .09$, $p < .001$) and more likely to be grouped with high-ability peers in their eighth-grade courses ($B = .06$, $p < .001$). Although both accelerated and nonaccelerated students participated in

Table 3. Effects of Educational Opportunities for Accelerated Students.

Achievement outcomes	Advanced courses[a]	High-ability group[a]	AP enrollment[b]	Number of AP exams[a]
High school				
PSAT-V	0.20	0.26	14.77* (3.58)	0.39*
PSAT-M	0.28	0.39*	18.29* (4.03)	0.47*
SAT-V	0.29*	0.34*	159.7* (36.00)	0.37*
SAT-M	0.28	0.41*	221.3* (37.55)	0.50*
ACT Composite	0.58*	0.51*	7.36* (2.42)	0.51*
ACT English	0.52*	0.42	6.85* (2.87)	0.41
ACT Reading	0.57*	0.37	7.45* (3.51)	0.35
ACT Math	0.53*	0.61*	9.73* (2.39)	0.61*
ACT Science	0.63*	0.60*	6.56* (2.58)	0.55*
High school GPA	0.25*	0.34*	0.68* (0.17)	0.42*
College				
First-year GPA	0.13	0.19	0.29 (0.20)	0.32*
Second-year GPA	0.16	0.22*	0.38* (0.17)	0.36*
Undergraduate GPA	0.17	0.27*	0.30* (0.14)	0.37*

Note. AP = Advanced Placement; PSAT-V = preliminary SAT-Verbal; PSAT-M = preliminary SAT-Math; SAT-V = SAT-Verbal; SAT-M = SAT Math; GPA = grade point average.
[a]Effects are reported as the correlations between amount of involvement in the program and educational outcome.
[b]Effects are the difference between participating in the program and not participating. Standard errors are provided parenthetically.
*Denotes statistical significance ($p < .05$).

Advanced Placement programs at some point ($B = .39$, $p = .18$), the accelerated students took more Advanced Placement exams ($B = .17$, $p < .001$).

Effects for Accelerated Students. Though acceleration increased the likelihood of participation in educational opportunities, a large number of grade skippers still did not participate. Once students had skipped ahead, could these additional opportunities provide another achievement boost? Yes; results suggest students who skipped a grade performed even better when acceleration was accompanied by other educational opportunities. Table 3 presents the impact of each type of educational opportunity on accelerated students' high school and college achievement outcomes. Involvement in these activities tended to provide additional advantage for accelerated students.

Eighth-grade students could enroll in advanced, enriched, or accelerated courses in English, mathematics, science, and social studies. The second column of Table 3 shows correlations between the proportion of advanced, enriched, or accelerated courses an accelerated student took and their high school and college achievement outcomes. The correlations were all positive and were generally moderate in strength, suggesting accelerated students, who took more advanced courses, performed better in terms of ACT scores (both composite and subject specific) and high school GPA.

A similar pattern is evident for students placed in the highest ability group in their English, mathematics, science, or social studies classes. As shown in the third column of Table 3, accelerated students who were more often included in high-ability groups tended to score higher on the SAT and many components of the ACT. Being grouped with high-ability peers was also associated with significantly higher grades in both high school and college.

Advanced Placement courses yielded similar dividends. As shown in the fourth column of Table 3, accelerated students who also took Advanced Placement courses scored more than 150 points higher on the SAT verbal and mathematics sections than students not taking those courses. Moreover, they had higher scores on all sections of the PSAT and the ACT and higher grades in high school. Beyond Advanced Placement participation, increases in Advanced Placement exams were also associated with improved academic outcomes. The last column of Table 3 summarizes these relationships. Accelerated students who completed more Advanced Placement exams also scored higher on PSAT, SAT, and ACT assessments and earned better high school grades relative to accelerated students who took fewer Advanced Placement tests. Finally, students who participated in Advanced Placement courses and took more Advanced Placement tests earned significantly better college grades.

Discussion

Prior research consistently demonstrates the effectiveness of acceleration as an educational practice for high-ability students (Colangelo, Assouline, & Gross, 2004; Kulik & Kulik, 1984; Rogers, 1992; Steenburgen-Hu & Moon, 2011). The results of the present study are largely consistent with extant literature, showing positive academic achievement outcomes in both high school and college for accelerated students. Advanced degree attainment is an exception to this general trend (accelerated NELS students did not earn more advanced degrees than their nonaccelerated counterparts), but the data may tell an abbreviated story. Survey waves ended 8 years after high school exit, and it is likely that students continued to pursue and earn degrees after the NELS data collection window closed in 2000. In fact, accelerated students may have been more likely to pursue and earn advanced degrees—31.4% of them were still enrolled in college in 2000, compared with 26.7% of their nonaccelerated peers.

Why would accelerated students outperform their matched peers over time? There are several plausible answers. One answer may derive from the characteristics of highly able, accelerated students. Students who are good candidates for acceleration tend to have processing skills in the top 2% to 5%, achieve two or more grade levels ahead in most academic areas, be frustrated with slow pace and repetition, have independent thoughts and actions, persist at tasks, prefer fast-paced and challenging learning, enjoy learning, and enjoy working with others of like ability (Assouline, Colangelo, Lupkowski-Shoplik, Lipscomb, & Forstadt, 2003). Accelerated students are typically self-motivated learners, exceptionally driven to acquire new knowledge and skills. The characteristics that make them good candidates for whole-grade acceleration may also propel them through successful high school and college careers.

In addition, acceleration implies rapid progress, and once students skip a grade, their speeded academic pace does not slow. In fact, "advanced ability tends to maintain its rapid pace of development" (Robinson, 1993, p. 511). NELS students accelerated prior to Grade 8 could have had much steeper growth trajectories than their nonaccelerated peers. Although their eighth-grade achievement was comparable to nonaccelerated peers, their faster rate of growth led them to earn higher high school GPAs 4 years later and higher college GPAs 4 years after that. In addition, eighth-grade matching was conducted on academic achievement (e.g., mastery of science concepts) rather than cognitive ability (e.g., IQ). Accelerated students who reached the same level of eighth-grade achievement in less time may have higher general ability, which could facilitate higher levels of later achievement.

In addition, the results suggest acceleration may boost students' involvement in other challenging educational opportunities, which provide additional benefit to academic achievement. This finding supports and extends other work which showed accelerated students taking Advanced Placement courses in high school fared better in college (Brody et al., 1990), and gifted students participating in Advanced Placement were more likely to earn advanced degrees (Bleske-Rechek, Lubinski, & Benbow, 2004). In this study, accelerated students were more likely to take advantage of additional educational opportunities, and accelerated students who did participate had higher achievement outcomes than those who did not. In other words, acceleration helps but the effects can be amplified when paired with opportunities for advanced academic study.

This research provides a novel contribution to the acceleration literature through its use of nationally representative data and its attention to the impact of postacceleration opportunities. Many studies of acceleration draw samples from particular talent search or university programs, where participation in that educational opportunity is a precondition for selection. By contrast, the NELS data include accelerated students with varied educational experiences and afford an opportunity for closer investigation of the programs that add to acceleration's effects.

Limitations

Although there are many benefits to using the NELS data, there are also some drawbacks. First, NELS relies heavily on survey responses. Although reliable external sources are used whenever possible (e.g., college transcripts, standardized achievement measures), students reported not only their participation in various educational opportunities but also some outcome measures. In these cases, students' self-reports could be inaccurate. Still, across a variety of outcome measures (near-term and distal), results were remarkably consistent. Accelerated students keep up with, and in many cases outperform, older, similar peers. Combining acceleration with enhanced educational opportunities such as advanced courses further strengthens already positive effects.

Another weakness relates to the definition of the treatment. Whole-grade acceleration is a relatively rare event, so all students who ever skipped a grade prior to eighth grade were grouped into a single category. Forming a single acceleration group may ignore differences in timing of grade skipping (e.g., early entrance to kindergarten, early entrance to first grade, elementary acceleration, middle school acceleration). Researchers argue that when it comes to identification and intervention for high-ability students, earlier is better (Silverman, 2012). Unfortunately, NELS data begin in eighth grade and cannot speak to the effect of acceleration timing on subsequent outcomes.

Future Directions

This research focuses on the effects of acceleration on high school and college outcomes, but many additional outcomes in the NELS data remain unexplored. For example, NELS contains information about respondents' jobs, occupational prestige, and earnings. Few longitudinal studies of highly able students focus on these outcomes, but the available research does indicate some positive impacts of acceleration on career achievement. Janos (1987) noted that a cohort of young, accelerated college students studied by Lewis Terman was more likely to enter the workforce at a younger age and in professional rather than service fields. Park et al. (2013) found that highly able mathematics students, who experienced whole-grade acceleration prior to college, authored more publications and more highly cited publications by the age of 50 years compared with nonaccelerated peers. NELS provides a rich data source for examining the effects of acceleration on work outcomes. For example, future research may investigate the types of careers entered by accelerated and matched nonaccelerated students as well as career advancement and earnings. These outcomes could also be informed by students' choice of college major.

It would also be useful to further explore the effects of educational opportunities on accelerated students' academic and career trajectories. This study showed challenging coursework such as advanced classes or Advanced Placement programs added value to accelerated students' academic experiences. It seems somewhat surprising that students who skipped a grade would not participate in some of these opportunities. Nonparticipating students were treated as a single group in these analyses, but it is likely that reasons for nonparticipation were varied. Some students may not have been interested in taking advanced courses. Others may not have had the opportunity (e.g., their school did not offer the course). The former implies a lack of motivation; the latter implies a lack of opportunity. Future research should work to disentangle motivation from opportunity and consider the separate impact of each. Other researchers have called for deeper study of motivation and opportunity (see Subotnik, Olszewski-Kubilius, & Worrell, 2011) because different policy decisions and instructional strategies are needed to increase each.

In sum, acceleration is an effective strategy for gifted learners, and accelerated students receive additional benefit from instructional programs tailored to their abilities. Talented students' academic prospects can be enhanced by coupling accelerative strategies with other educational opportunities such as advanced, enriched, or accelerated classes; within-class ability grouping; and Advanced Placement courses. Accelerated students who continue to receive and take advantage of these specialized opportunities should realize benefits that persist beyond K-12 schooling. These findings have critical implications if we mean to maximize gifted students' potential. Highly able learners should not only be allowed to accelerate but should also be provided multiple avenues for advanced study; across outcomes and over time, these opportunities boost gifted learners' odds of further success.

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Notes

1. Gender, race, and SES were used as demographic matching covariates because each has been shown to substantially influence academic outcomes (Tate, 1997). Matching on these demographic characteristics therefore reduces bias in estimates of acceleration effects.
2. Correlations among the four content-area assessments ranged from 0.69 to 0.72, and the four assessments' loadings on the achievement composite were nearly equal, ranging from 0.498 to 0.503.
3. For the purposes of matching, race is defined as a binary variable. Nonminority students include Whites and Asians. Minority students include all other races.
4. This procedure yielded 768 possible strata (48 achievement × 4 SES × 2 gender × 2 race), allowing all 105 accelerated students to be matched. Alternately, if individual achievement scores rather than the achievement composite were divided into a tenth of a standard deviation unit bins, there would be 64,423,632 strata (39 reading × 43 math × 49 science × 49 history × 4 SES × 2 gender × 2 race), and only one accelerated student would have a match. If the bins were widened to half a standard deviation, there would still be 115,200 strata, and only 55 accelerated students would have matches. Propensity score matching (PSM) could have been used to address large numbers of strata, but PSM was designed to reduce imbalance in the mean of each matching variable; imbalance in the multidimensional distribution of those variables may still exist. Advantages of CEM are that (a) maximum imbalance for any individual matching variable is limited by the researcher-selected level of coarsening and (b) multivariate imbalance is reduced by accounting for the relationship between variables (through strata). In several demonstrations, CEM has outperformed PSM across multiple balance measures (Iacus et al., 2011; Iacus, King, & Porro, 2012).
5. The PSAT/NMQT and SAT both currently offer a writing assessment, but this component was not available in 1990 and 1992 when the NELS data were collected.
6. The ACT also offers an optional writing section, but this was not available when NELS data were collected.
7. NELS recorded only enrollment status, not the reasons for that status; it was therefore not possible to discern whether students did not enroll in an Advanced Placement program because they did not have the prerequisite skills, chose not to participate, or attended a school that did not offer such a program.
8. Matching variables are those in the top section of Table 1.

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