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Long-Term Effects of Educational Acceleration

Introduction

Given the expertise of the contributors to this volume and the necessary space limitations imposed upon authors, this brief chapter will focus on a series of recent findings. The Study of Mathematically Precocious Youth (SMPY) has, over the past four years, published four extensive longitudinal reports. Collectively, they contain evaluations of the subjective feelings and educational-vocational outcomes of thousands of participants, from five cohorts assembled over three decades (Lubinski & Benbow, 1994), who have experienced many different kinds of educational acceleration (Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000; Bleske-Rechek, Lubinski, & Benbow, 2004; Lubinski, Benbow, Shea, Eftekhari-Sanjani, & Halvorson, 2001; Lubinski, Webb, Morelock, & Benbow, 2001). These findings are especially important because, among other things, they contain evaluations of adults based on 10- and 20-year longitudinal achievement and reflection. Hence, in addition to conventional criteria, they enable us to ascertain whether participants of accelerative learning opportunities harbor subsequent regrets. Because these findings are fresh, they will be reviewed in detail; but the focus will be on outcomes and subjective impressions exclusively tied to educational acceleration. Readers are referred to the original reports for more extensive findings on the life patterns of this special population.

In a shorter section, some writings of previous generations of leading psychologists will be drawn on. By examining the historical record of those committed to educational practice based on science, it is remarkable how many modern empirical findings were anticipated, and to some extent documented, by early pioneers (Allport, 1960; Hobbs, 1951, 1958; Hollingworth, 1926, 1942; Paterson, 1957; Pressey, 1946a, 1946b, 1949; Seashore, 1922, 1930, 1942; Terman, 1954; Thorndike, 1927; Tyler, 1974).[1] For decades, it is clear that we have known a number of general principles about meeting the needs of intellectually precocious youth, and modern empirical findings have added precision and multidimensionality to this knowledge. Yet, putting this research into practice has been difficult due to a variety of political and social forces that always operate on educational policy and practice (Benbow & Stanley, 1996; Stanley, 2000). Due in no small part to talent searches, and the efficiency with which talent searches facilitate large-scale longitudinal research, an impressive empirical literature has developed to support and add refinement to the efficacy of educational acceleration for intellectually precocious youth (Colangelo & Davis, 2003; Lubinski & Benbow, 2000; VanTassel-Baska, 1998). It is becoming increasingly difficult to neglect the evidence that has emerged (Ceci, 2000; Stanley, 2000). Today, we have a much better understanding of how to identify intellectual precocity, the nonintellectual attributes that facilitate its development, and the learning environments needed for actualizing truly exceptional potential. Hopefully, this volume will contribute toward moving these findings into educational policy and practice.

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[1]*Clearly, if discourse is restricted to those committed to practice based on science, many of the longitudinal findings reviewed herein were anticipated by earlier workers (see, for example, Hollingworth, 1926, 1942; Paterson, 1957; Pressey, 1946a, 1946b, 1949, 1955, 1967; Seashore, 1922, 1930, 1942; Terman, 1954; Thorndike, 1927; Tyler, 1974; Williamson, 1965; Witty, 1951). What modern findings have given us, however, is a better conceptual and more technical appreciation of the psychological diversity of intellectual talent, and the personological dimensions and motivational forces driving talent development toward the acquisition of expertise. A detailed review of the evolution of these developments, and the key historical figures involved, is found in Achter and Lubinski (2003).*

Identifying Students for Accelerative Opportunities and Calibrating Learning Expectations

Pressey (1949, p. 2) defined educational acceleration as "progress through an educational program at rates faster or at ages younger than conventional." This is an excellent characterization, and will be utilized here. There are multiple ways to identify students for accelerative learning experiences, but modern talent searches are among the most widely utilized. Because all but one study reviewed herein utilized this selection procedure, it is important to understand how talent searches work and what they have achieved (see Olszewski-Kubilius, this volume, for more detail).

Talent searches identify young adolescents scoring in about the top 3% on conventional achievement tests administered in their schools and afford these students opportunities to take college entrance exams. They have grown from under 500 students in 1972 to around 200,000 seventh and eighth graders annually. These students routinely produced Scholastic Assessment Test (SAT) score distributions in quantitative reasoning (SAT-M) and verbal reasoning (SAT-V) mirroring high school seniors. Those scoring at or above the mean on these distributions can assimilate a full high school course (chemistry, English, mathematics) in three weeks time; those scoring in the top 1 in 10,000 nationally in general, quantitative, or verbal ability can assimilate more than twice this amount (Benbow & Stanley, 1996; Stanley, 2000). Modern longitudinal findings have also documented that opportunity matters in other ways.

Whereas Terman's (1925, 1959) male-female participants differed markedly in their achievements, findings on more contemporary samples reveal that the sexes are earning educational credentials commensurate with their abilities (Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000; Lubinski, Benbow, Shea, Eftekhari-Sanjani & Halvorson, 2001). Across both sexes, young adolescents with general, quantitative, and verbal abilities in the top 1 in 100 secure doctorates at 25 times base rate expectations (25%), while those scoring among the top 1 in 10,000 secure doctorates at 50 times base rate expectations (50%); moreover, the caliber of the universities attended and the creative products generated by this latter (profoundly-gifted) group reveal a much steeper, much more impressive developmental trajectory. Furthermore, the specific nature of their educational development is in part a function of ability pattern: individuals who are more verbally than mathematically talented tend to develop in different but predictable ways from those with the inverse pattern (Lubinski, Webb, Morelock, & Benbow, 2001; Shea, Lubinski, & Benbow, 2001). Collectively, ability level and pattern are both needed to calibrate expectation for learning among students with the potential to profit from course work more rigorous than the norm, and volumes devoted to how this is accomplished are readily available (Benbow & Lubinski, 1996; Colangelo & Davis, 2003; VanTassel-Baska, 1998).

The questions examined here are: How do participants, identified as intellectually precocious at an early age, and who have in general achieved so much, feel about their accelerative educational experiences or lack thereof now that they are adults? Can any conclusions be drawn about their life outcomes, based on their accelerative experiences? And do they as adults harbor regrets about their accelerative educational experiences?

Before reviewing longitudinal findings to answer these questions, some cautionary notes are in order. First, evaluating the educational efficacy of accelerative opportunities will always be quasi-experimental (Campbell & Stanley, 1963; Cook & Campbell, 1979; see, e.g., Bleske-Rechek, Lubinski, & Benbow, 2004; Swiatek & Benbow, 1991a, 1991b), because opportunities have not been withheld from willing and able students due to ethical considerations (so random assignment to accelerative versus non-accelerative opportunities is prohibitive). We already know, from earlier research, that the likely outcomes are positive (Benbow & Stanley, 1996; Heller, Mönks, Sternberg, & Subotnik, 2000; Kulik & Kulik, 1984; Southern, Jones, & Stanley, 1993). Second, since the early 1970s, the opportunities available to intellectually precocious youth have been (and will continue to be) in a continuous state of change due to refinements based on ongoing research. Over the past three decades in particular, accelerative learning opportunities have not only increased in schools but also have become more responsive to the needs of talented youth. Hence, 10-year longitudinal studies (to say nothing of 20-year studies), are always somewhat dated. Nevertheless, as these studies show, across objective and subjective measures, multiple identification procedures, and many different kinds of remote criteria (Humm, 1946) that a curriculum that moves at a pace commensurate with rate of learning (or, for precocious learners, accelerative learning relative to the norm) is educationally and developmentally advisable.

Four Key SMPY Longitudinal Studies

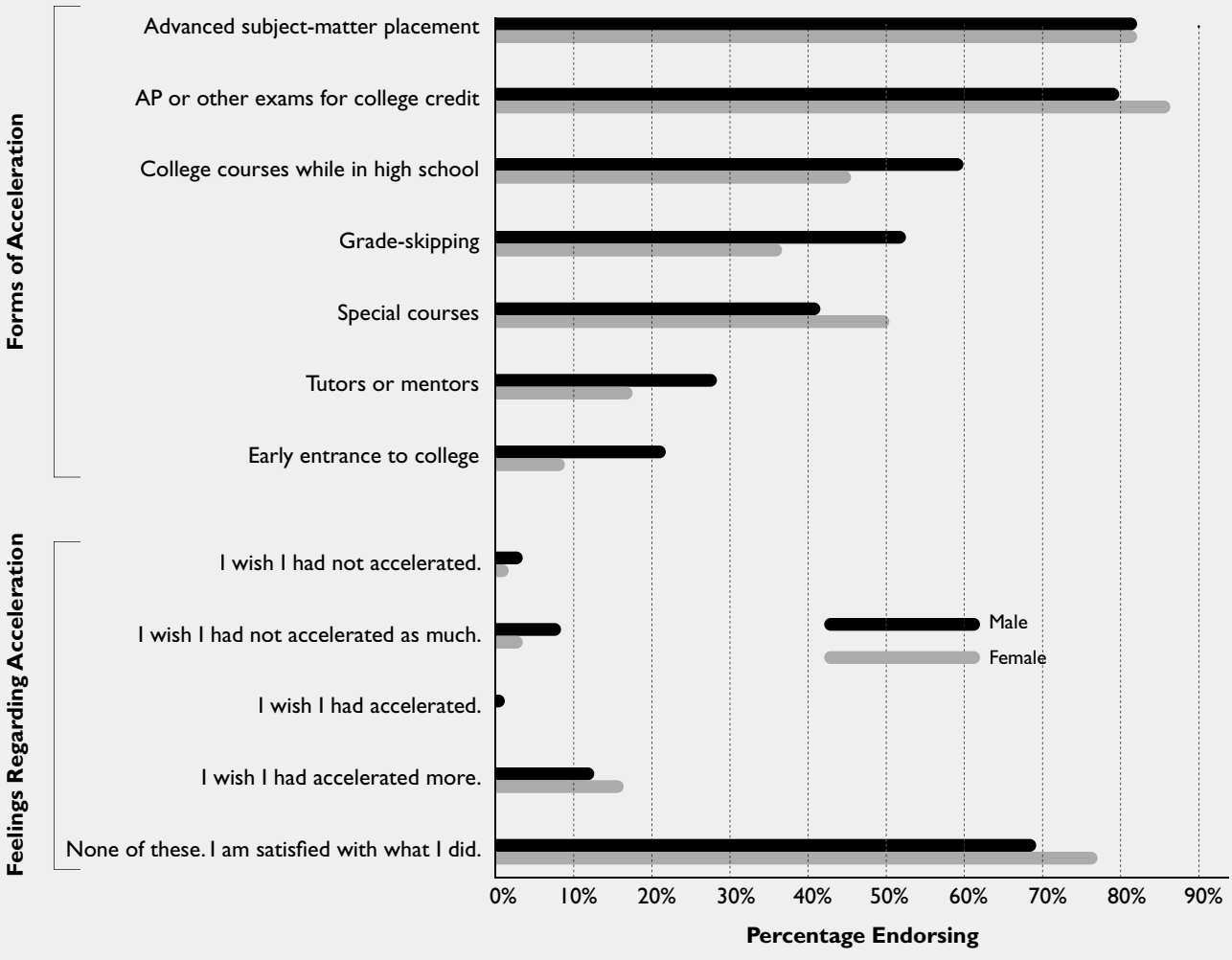
Study 1

(Lubinski, Webb, et al., 2001, Journal of Applied Psychology, *86, 718-729). A 10-Year Longitudinal Study of the Top 1 in 10,000 in mathematical or verbal reasoning (N = 320) identified in the early 1980s (at age 13) [SMPY Cohort 3].*

This study is important in several respects: it consists of SMPY's most able cohort (Mean IQ > 180), and it was the first longitudinal follow-up where the profoundly gifted had been systematically assessed on specific abilities with a sample large enough for meaningful generalizations. Figure 1 illustrates the heterogeneous collection of accelerative opportunities taken advantage of by this special population. And the intensity of these experiences was extraordinary. Across both sexes, +80% took advanced subject-matter placement and AP exams for college credit, and +50% took college courses while in high school. Importantly, when participants were asked how they felt about their accelerative experience, the majority (+70%) expressed satisfaction with what they did. For those who felt differently, more participants wished that they had accelerated more (+13%), relative to participants who (now as young adults) wished that they had not accelerated (5%). Figure 2 illustrates a number of subjective views among participants across a variety of areas. From the participants' point of view, the impact of accelerative experiences on an array of educational and personal aspects of life ranges from "No effect" to "Favorable effects."

Figure 1.

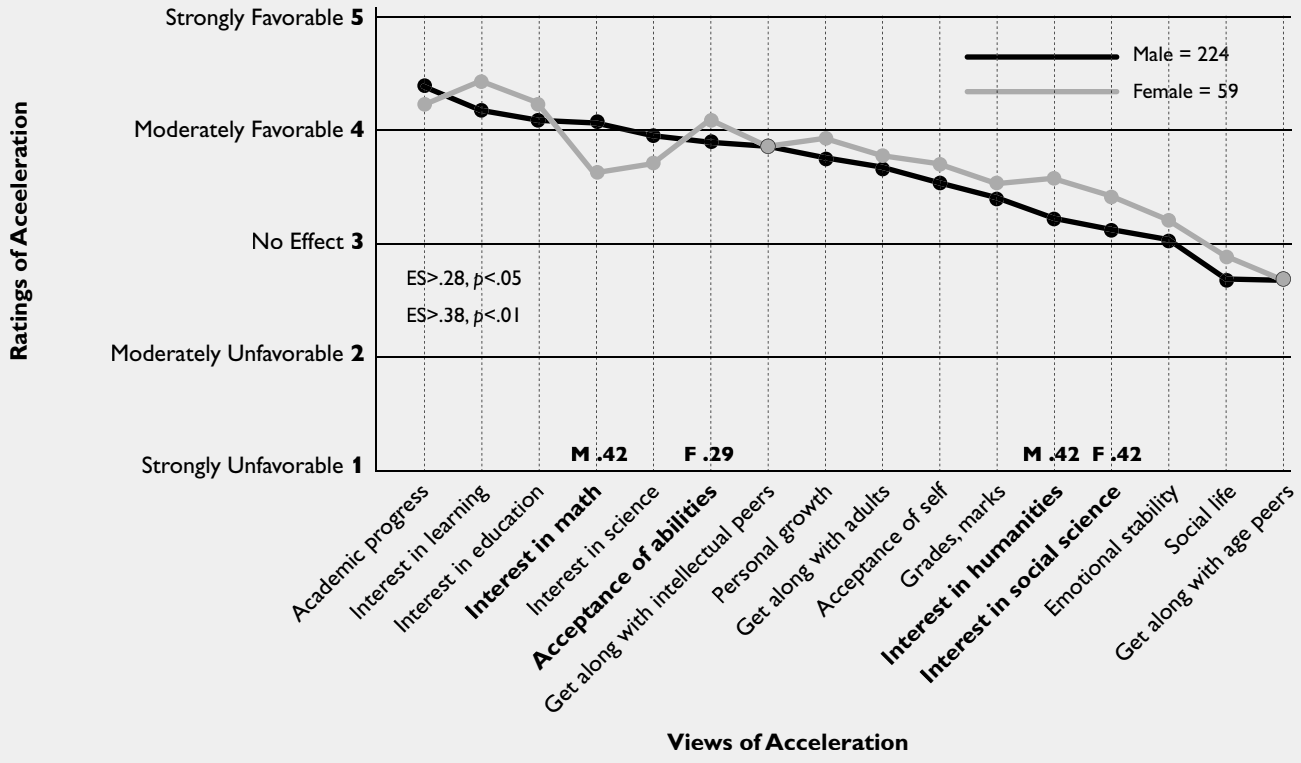
Participation in Accelerative Programs and Satisfaction of SMPY Cohort 3



From Lubinski, Webb, et al. (2001).

Figure 2.

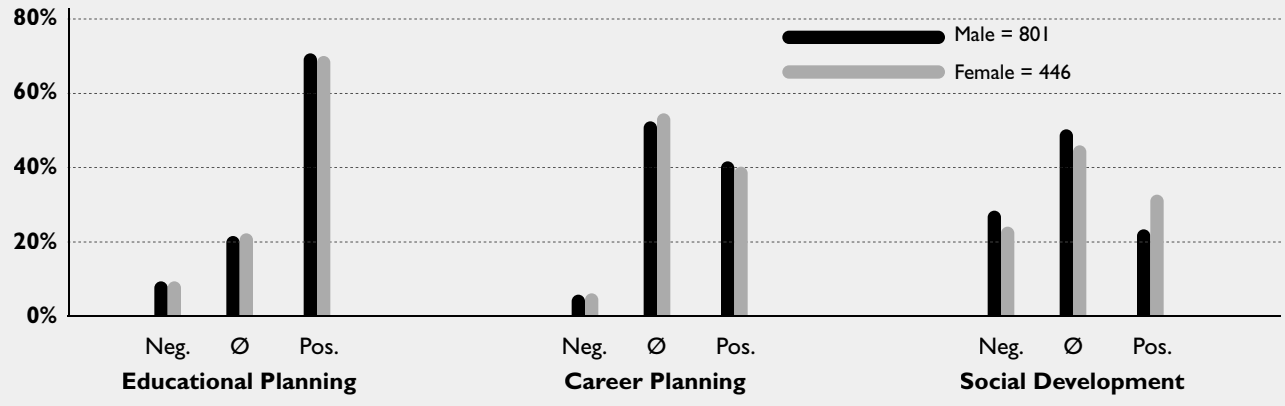
Subjective Views Regarding Acceleration



From Lubinski, Webb, et al. (2001).

Figure 3.

Influence of Educational Acceleration on . . .



From Benbow, et al. (2000).

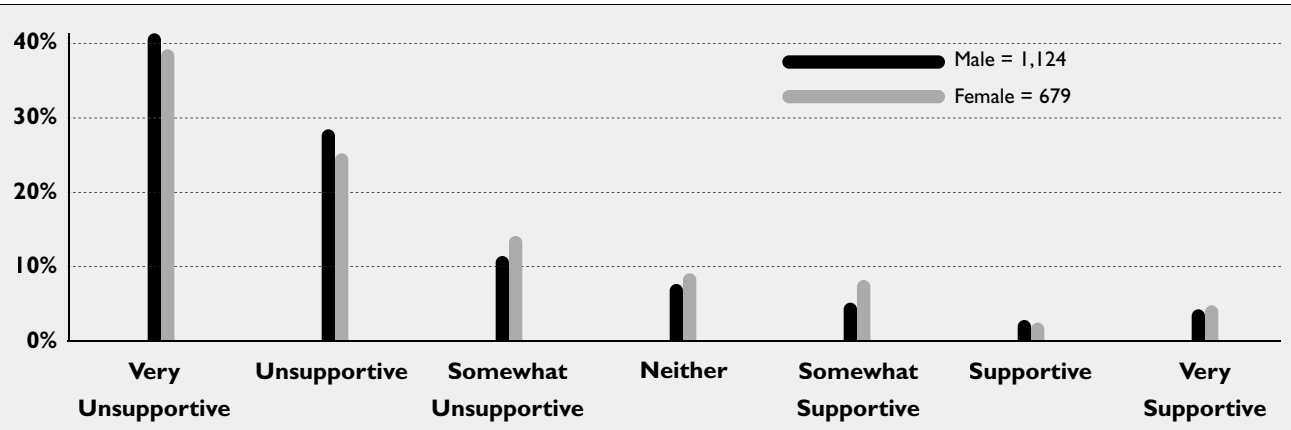
Study 2

(Benbow, et al., 2000, Psychological Science*, 11, 474-480): A 20-Year Longitudinal Study of the Top 1% (N = 1,975) in mathematical reasoning ability (some of whom were more verbally than mathematically precocious), identified throughout the 1970s (at age 13) [SMPY Cohorts 1 & 2].*

In this study, at age 33, participants who were accelerated were asked how they perceived acceleration to have affected their educational planning, career planning, and social development (Figure 3). Clearly, acceleration was seen to have its most helpful effects on educational planning, but significant perceived effects on career planning were also observed. Social

Figure 4.

Support for Eliminating Homogeneous Grouping



"A number of educational policy makers have proposed the following: eliminating homogeneous grouping for instruction (i.e., grouping students according to their abilities and skills, as in reading groups and honors classes) and, instead, teaching students of all ability levels in the same group. How supportive are you of this proposal?"
From Benbow, et al. (2000).

development was more ambiguous. Yet, here it is good to keep in mind the limited range of accelerative options available to kids back in the 1970s, which would have kept them with their same aged peers. Nevertheless, at the very least, the effects of acceleration on their social development appeared to be essentially neutral.

Finally, participants were asked how they felt about some educational policy makers arguing for the elimination of homogeneous grouping for instruction. The question was worded negatively to stack the deck against homogeneous grouping, thus (all participants were asked):

> *"A number of educational policy makers have proposed the following: eliminating homogeneous grouping for instruction (i.e., grouping students according to their abilities and skills, as in reading groups and honors classes) and, instead, teaching students of all ability levels in the same group. How supportive are you of this proposal?"*

As Figure 4 readily reveals, participants tend to be very much against eliminating homogeneous grouping for instruction. And the pattern is highly consistent across both sexes. Study 3 below offers some reasons for why.

Study 3

(Bleske-Rechek, et al., 2004, Psychological Science, 15, 217–224): Three Decades of Longitudinal Data on the Advanced Placement (AP) Program (N = 3,700) [SMPY Cohorts, 1 through 5].

Here, pooled findings taken from the above samples [SMPY Cohorts 1, 2, and 3], were combined with two additional samples. The first additional sample consisted of (N = 173) top 1% young adolescents (identified at ages 12–14, primarily from within the state of Iowa) between 1992 and 1997 [SMPY Cohort 4]. The second additional sample was not a talent search sample; they were first- and second-year graduate students attending top math/science training programs throughout the U.S. in 1992 (N = 709) [SMPY Cohort 5]. Data from top math/science graduate students complements longitudinal data from talent search participants, and adds information from the point of view of yet another extraordinary population of human capital identified in another way. (Their characteristics will be reviewed in more detail below, see Study 4, and are much more extensively in the original report.)

This study is exclusively restricted to the subjective feelings and educational outcomes based on Advanced Placement (AP) versus non-Advanced Placement (AP) participation. This study is especially important because AP opportunities are viewed by many as the most effective and comprehensive program in place for meeting the educational needs of students whose abilities and motivation for academic achievement is well beyond the norm.

To cut the details of this study down to manageable dimensions, all four talent search groups were combined, but the math/science graduate students were kept separate. Participants reported the number of AP coursework and AP exams. They also were asked to supply open-ended responses to the following questions: "What did you like most about your high school experience?" and "What did you like least about your high school experience?" For talent search participants, high school likes and dislikes, plus their three favorite high school courses, were secured over various post-high school follow-ups. For the math/science participants, they reported this information when initially surveyed in 1992.

Table 1.

Domains of High School Likes and Dislikes, and Their Respective Categories

Likes	Dislikes
Academic and Intellectual Activities	**Lack of Intellectual Stimulation or Engagement**
Intellectual Engagement	Lack of Intellectual Engagement
Teachers and Instruction	Teachers and Instruction
Classes and Departments	Classes and Departments
Success and Recognition	Lack of Success and Recognition
Social Life and Extracurricular Activities	**Social Isolation and Peer Pressure**
Extracurricular Involvement	Limited Extracurricular Involvement
Socializing and Meeting People	Socializing and Meeting People
	Social Isolation and Insecurity
	Peer Pressure
Other	**Other**
School Community and Structure	School Community and Structure
Life/Life Stages	Life/Life Stages
Lack of Intellectual Demand	Intellectual Demand
Global/Miscellaneous	Global/Miscellaneous

From Bleske-Rechek, et al. (2004).

Table 2.

Involvement in the Advanced Placement (AP) Program During High School, by Cohort and Sex

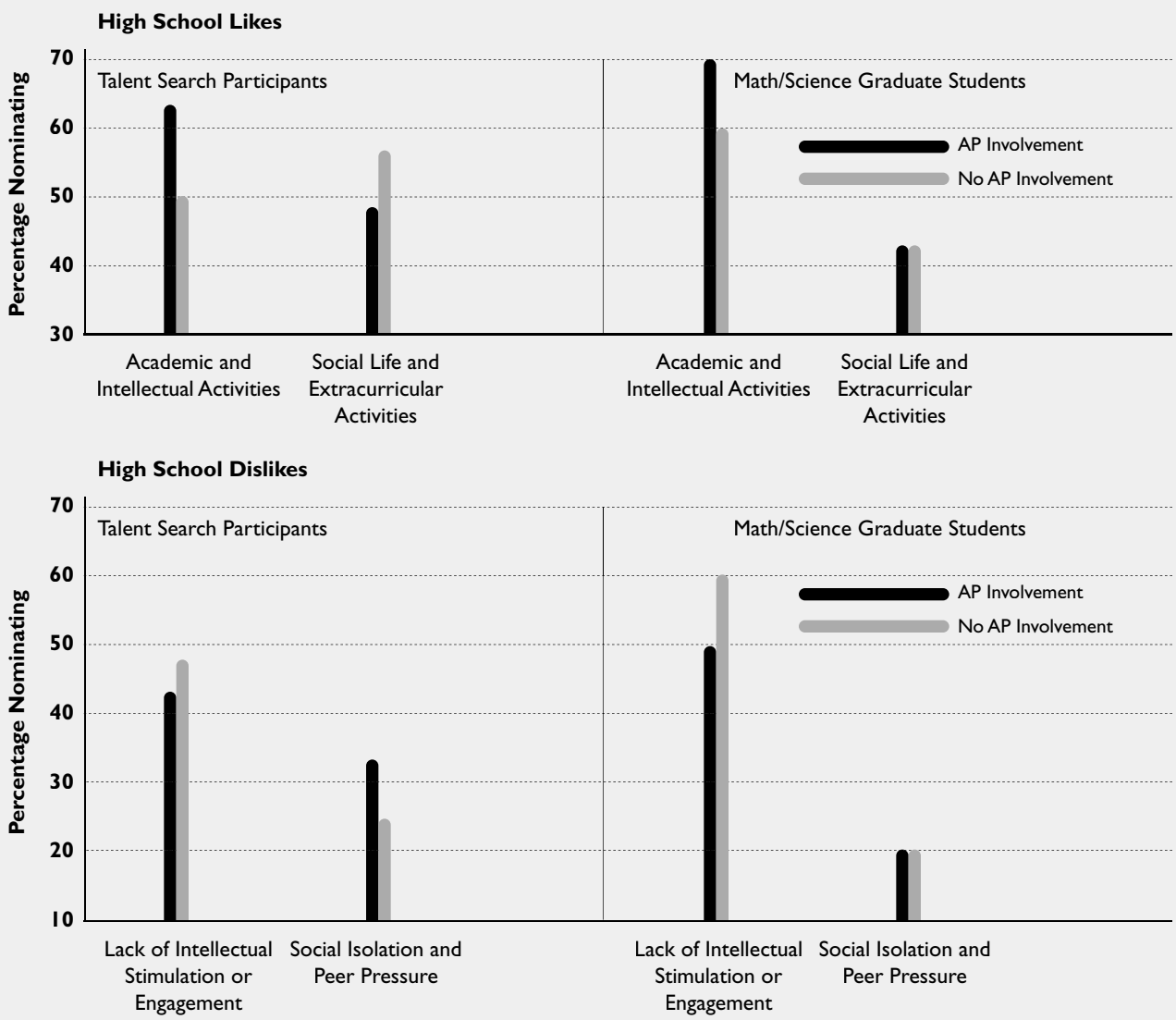
	Cohort 1 Talent Search 1972–74		Cohort 2 Talent Search 1976–79		Cohort 3 Talent Search 1980–83		Cohort 4 Talent Search 1992–97		Cohort 5 Graduate Students 1992	
	M	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**
Respondent N:	1195	764	401	167	328	108	95	78	368	341
Percentage who took one or more AP courses or exams	41.8$_c$	29.3$_c$	80.8	77.8	86.0$_a$	76.9$_a$	79.0	80.8	75.8	77.4
Mean number of courses or exams taken	2.1$_c$	1.8$_c$	3.3$_b$	2.7$_b$	4.2$_b$	3.5$_b$	3.8$_a$	2.9$_a$	3.3	3.2
Percentage who nominated an AP course as their favorite course in high school	—	—	—	—	35.4	26.4	47.6	49.1	27.6	22.5

Note. M=Males; F=Females. "—" denotes unavailable data. Male-female contrasts significant at p<.05, p<.01, and p<.001 are denoted by a, b, and c, respectively. Values shown for talent search participants from 1972–83 include an unknown number of participants who did not have AP courses available at their high school. Values for talent search participants from 1972–74 include only AP exam-taking in high school; values for all other participants include both AP course- and exam-taking. Values for favorite course nominations were calculated using the number of participants involved in the AP program as the denominator; Ns are reduced for 1980–83 talent search analyses because calculations required data from both the 5- and 10-year follow-ups.
From Bleske-Rechek, et al. (2004).

To code participants' high school likes and dislikes, we initially compiled a master list of 223 distinct sub-categories. After coding participants' idiographic responses according to this list, we formed three domains of likes: Academic and Intellectual Activities, Social Life and Extracurricular Activities, and Other; and, conversely, three domains of dislikes: Lack of Intellectual Stimulation or Engagement, Social Isolation and Peer Pressure, and Other. These domains, along with their respective categories, are displayed in Table 1.

Figure 5.

Perceptions of High School Experiences as a Function of AP Instruction



Percentage of SMPY participants who nominated academic and social high school likes (top panel) and dislikes (bottom panel) as a function of their involvement in the Advanced Placement program during high school. Participants nominated up to 6 high school likes (talent search $\overline{X}$=1.75; graduate student $\overline{X}$ =1.76) and 6 high school dislikes (talent search $\overline{X}$ =1.39; graduate student $\overline{X}$ =1.47). Sample sizes are as follows: talent search participant likes: AP=1271, No AP=925; dislikes: AP=1165, No AP=891; math/science graduate student likes: AP=461, No AP=223; dislikes: AP=433, No AP=216.
From Bleske-Rechek, et al. (2004).

AP Involvement

Table 2 displays rates of AP involvement. Except for Cohort 1, for whom AP was not yet widely available, over 75% of participants reported taking at least one AP course or exam. The values for Cohorts 4 and 5 exclude those students for whom AP was not available (AP courses or exams were not available for 20% of Cohort 4 and 23% of Cohort 5), but the values for Cohorts 1 through 3 do not. Hence, the values shown for Cohorts 1 through 3 are lower-bound estimates because they include an unknown number of participants without AP opportunities.

Between 22 and 49% of participants who took at least one AP course also nominated it as a favorite high school class. These values, too, are conservative estimates because favorite class nominations were not coded as AP unless participants explicitly labeled them as AP. Thus, common nominations such as Organic Chemistry, Calculus I and II, and Multivariate Calculus were not coded as AP, although they likely were AP courses (or courses taken at a local university while students were still in high school).

Table 3.

Percentage nominating academic-related categories of high school likes and dislikes, by sex

	Talent Search Participants		Math/Science Graduate Students	
Academic-related category (and representative nominations)	**M**	**F**	**M**	**F**
Likes				
Intellectual Engagement 'Opportunity to take advanced placement classes.' 'Working hard in my classes.' 'Association with highly intelligent classmates.' 'Solid education – good preparation for college.'	33.0	34.9	33.6_a	41.5_a
Teachers and Instruction 'Several supportive and encouraging teachers.' 'Intelligent and knowledgeable teachers.' 'Several teachers encouraged advanced learning.' 'Getting to know teachers.'	15.0_a	18.4_a	19.8_a	27.6_a
Classes and Departments 'Math and language courses.' 'Well-balanced curriculum.'	11.8_b	15.9_b	10.7_b	18.5_b
Success and Recognition 'Excelling at academics.' 'Receiving recognition from others for my academic achievement.'	5.5	6.1	3.7	4.8
Dislikes				
Lack of Intellectual Engagement 'The slow pace of instruction in most classes.' 'Not being challenged intellectually.' 'Lack of intelligent, motivated peers.' 'Poor education – I wasn't taught enough.'	23.5	23.6	31.0	32.9
Teachers and Instruction 'Unenthusiastic, controlling teachers.' 'Some teachers were not bright.' 'Teachers who tried to inhibit my advancement.' 'Half the teaching was mediocre.'	8.5	9.4	14.6	16.9
Classes and Departments 'Boring, required classes.' 'English and reading Shakespeare.'	9.3	10.5	13.4	14.1
Intellectual Demand 'Quizzes.' 'Doing homework.'	6.7	5.4	4.2	4.2

Note. M=Males; F=Females. Male-female contrasts significant at p<.05 and p<.01 are denoted by a and b, respectively. Talent search Ns are as follows: Male likes = 1327 and dislikes = 1252; female likes = 797 and dislikes = 755. Graduate student Ns are as follows: Male likes = 354 and dislikes = 336; female likes = 330 and dislikes = 313. Non-respondents have been omitted from analyses. Other academic-related categories were nominated by fewer than 2.5% of participants and thus are not shown here.
From Bleske-Rechek, et al. (2004).

Table 4.

Predicting Advanced Degree Status at the Age 33 Follow-up

	Talent Search 1972-74		Talent Search 1976-79	
Variable entered	**Multiple R**	**Incremental R^2**	**Multiple R**	**Incremental R^2**
SAT-M (before age 13)	$.20_c$	—	$.16_b$	—
AP Involvement	$.34_c$	$.07_c$	$.28_c$	$.05_c$

Note. Age-33 follow-up data were available only for the first two talent search cohorts. Respondent N for talent search 1972–74 = 1263; for 1976–79 = 469. SAT scores were secured at initial data collection, reports of AP involvement at 5-year follow-up, and reports of advanced degrees at 20-year follow-up. Advanced degrees include master's degree or equivalent, doctoral degree or equivalent, medical degree, or law degree. Values of $p<.01$ *and* $p<.001$ *denoted by b and c respectively. From Bleske-Rechek, et al. (2004).*

High School Likes and Dislikes

Figure 5 displays participants' perceptions of their high school experiences as a function of AP involvement. Cohorts 1 through 4 are combined because the same pattern was replicated in each talent search cohort. Overall, participants valued academic and intellectual stimulation in high school and found the lack of it distressing. Table 3, which displays representative likes and dislikes from academic-related categories, shows that participants regularly voiced positive reactions to working hard, being intellectually challenged, and being with their intellectual peers. Across samples, over a third of participants nominated either intellectual challenge, opportunities for acceleration, pro-intellectualism, school work, academic clubs, or excelling at academics as something they liked most about their high school experience. Fewer than 7% nominated tests, exams, homework, or quizzes as something they disliked. Overall, participants placed more emphasis on academics than on socializing. When asked what they liked most about high school, over 60% cited something academic (i.e., academic and intellectual activities), whereas 49% cited something social (i.e., social life and extracurricular activities). When asked what they liked least, over 45% cited something academic (i.e., lack of intellectual stimulation or engagement), and 30% cited something social (i.e., social isolation and peer pressure).

Participants' high level of intellectual engagement was underscored by their likes and dislikes as a function of AP involvement. As displayed in Figure 5, talent search participants and graduate students who took one or more AP courses were more likely than those who did not to nominate academic and intellectual activities as a favored aspect of high school: talent search, $\chi^2(1, N = 2196) = 27.51$, $p < .001$; graduate students, $\chi^2(1, N = 684) = 10.70$, $p < .01$. Among both groups, individuals involved in AP were less likely to nominate a lack of intellectual stimulation or engagement as a disfavored aspect of high school: talent search, $\chi^2(1, N = 2056) = 4.19$, $p < .05$; graduate students, $\chi^2(1, N = 649) = 6.41$, $p < .05$. Among talent search participants only, individuals who were involved in AP were less likely than those who were not involved in AP to nominate social life and extracurricular activities as a favored aspect of high school, $\chi^2(1, N = 2196) = 9.91$, $p < .01$, and more likely to nominate social isolation and peer pressure as a disfavored aspect, $\chi^2(1, N = 2056) = 12.10$, $p < .001$.

Advanced Degrees

Longitudinal data on secured educational credentials were available for participants in Cohorts 1 and 2. At age 33, 70% of individuals who had taken one or more AP courses or exams during high school had obtained an advanced degree (master's or beyond), compared to 43% of those who had not taken an AP course or exam. Table 4 displays multiple regression analyses controlling for mathematical reasoning ability (SAT-M scores at or before age 13) in the prediction of advanced degree status. (SAT-V scores were available for only approximately half of participants.) Although SAT-M scores predicted advanced degree attainment 20 years later, AP involvement accounted for an additional 7% and 5% of variance in advanced degree status for Cohorts 1 and 2, respectively. Thus, through self-selection or something intrinsic to the AP program itself, AP involvement is a positive predictor of educational success and satisfaction for intellectually talented youth.

Overall, intellectually talented youth embraced and placed a premium on intellectual challenge in high school. The majority participated in AP. Those who did more frequently expressed satisfaction (and less frequently expressed dissatisfaction) with the intellectual caliber of their high school experience. Moreover, students who participated in AP were more likely to earn an advanced educational degree, even after controlling for mathematical reasoning ability.

Normative data suggest that the high school mindset of

Table 5.

Educational Experiences (%) of Graduate Student and Talent Search Males and Females

	GS		TS	
	M	F	M	F
Interest in math/science stimulated by a special person	61	69	68	73
Math/science contest or special program before college	**58**	**54**	**54**	**37**
Accelerated primary and/or secondary education ...				
via advanced subject-matter placement	58	62	68	60
via AP or other exams for college credit	66	67	92	88
via college courses during high school	33	33	37	29
via grade skipping	11	13	23	28
by any means	88	91	92	92
Reported positive influence of acceleration experience	78	80	70	70
Reported negative influence of acceleration experience	2	1	10	8
Took biology, chemistry, physics, and calculus during high school	68	66	65	60
Favorite high school class in math or science	**79**	**74**	**64**	**39**
Selected for the National Honor Society	70	79	63	70
Was National Merit finalist	23	21	42	38
Awarded National Merit Scholarship	15	17	23	21
Was Presidential Scholar	13	13	3	5
Experienced mentoring relationship before college	28	28	33	34
Positive influence on educational/career plans	96	97	95	89
Negative influence on educational/career plans	3	0	2	2
Math/science contest or special program during college	**20**	**21**	**25**	**11**

Note. Substantive item comparisons are displayed in bold. Group Ns vary by item. GS = graduate students, TS = talent search, M = males, F = females. From Lubinski, Benbow, et al. (2001).

intellectually talented youth differs markedly from that of their typical age mates. Recall that over 60% of participants cited something academic as a favored aspect of their high school experience, whereas 49% cited something social (30% cited friends and socializing, and 29% cited extracurricular activities; some nominated both). In contrast, 85% of a representative sample of 1560 Indiana high school students cited friends and socializing as a favored aspect of high school, with less than half that (40%) nominating educational benefits (Erickson & Lefstein, 1991). Further, less than 2% of intellectually talented participants, compared to 19% of Indiana high school students, nominated the opposite sex and dating as a favored aspect. Less than 7% of SMPY participants nominated exams, homework, or studying as something they disliked about high school, while 35% of Indiana youth nominated homework or term papers, and 6% nominated tests and exams (Erickson & Lefstein, 1991). Across groups, 2% of SMPY participants nominated early mornings, and 1% nominated long school days, as aversive; of Midwestern high school students, 23% complained about getting up early and 20% about long school hours or days.

Although the Indiana youth were surveyed while still in high school and SMPY participants after high school, SMPY participants' pattern of responses was robust across a wide range of longitudinal follow-ups. The overall picture of intellectually talented youth is one of young men and women who have an intense need for intellectual growth and who are invested in their intellectual development. Their distinct learning preferences (cf., NRC, 2002, annex 6–1, pp. 11–14) necessitate a differentiated curriculum. In contrast, a significant subset of normative high school students appears to be more concerned about socializing and dating, and more annoyed by homework and early mornings. AP opportunities appear to facilitate the positive development of highly motivated students who learn at rapid rates. Yet, like all educational interventions, AP is not a panacea. For profoundly gifted students, for example, AP coursework may need to be combined with grade skipping, taking college courses early, and even going to college early (Lubinski, Webb, et al., 2001, Study 1 above).

Table 6.

Educational Experiences of Graduate Student Males and Females

	M	F
Participated in a talent search during junior high school	15	13
Believe would have been eligible for talent search	63	62
Believe would **not** have been eligible for talent search	7	8
Would have enrolled in talent search	65	72
Gifted programs were available at some point	74	78
Participated in gifted program (given available)	86	84
Ave. number of years participated in gifted programs (*SD*)	5.2 (2.9)	5.4 (2.9)
Participated in a summer program for the gifted	26	23
Positive experience from gifted programs	67	71
Negative experience from gifted programs	3	3
Worked on independent research project during high school	25	23
Took honors course during high school in:		
Humanities	52	59
Social studies	42	45
Languages	30	38
Science	66	68
Changed undergraduate major	29	35
From program outside math/sciences	12	11
Age decided on undergraduate major (*SD*)	17.7 (2.1)	18.1 (1.8)
Participated in undergraduate research program	83	83
Positive influence on career/educational plans	88	88
Negative influence on career/educational plans	5	4
Experienced mentoring relationship as undergraduate	57	61
Positive influence on educational/career plans	96	94
Negative influence on educational/career plans	1	3
Undergraduate honor society (e.g., Phi Beta Kappa)	71	76
Median number of graduate school hours spent on:		
Studying	20	20
Research	30	30

Note. No significant difference found at alpha = .01. Statistics represent percentages, except where otherwise specified. From Lubinski, Benbow, et al. (2001).

Study 4

(Lubinski, Benbow, et al., 2001, Psychological Science, *12, 309–317). A Comparison of Top Math/Science Graduate Students (females = 346, males = 368) with same-age SMPY Participants Tracked Over 20-Years (females = 528, males = 228) [SMPY Cohorts 2 & 5].*

The final study to be reviewed was not based on a talent search population. This study was based on the math/science population (whose AP experiences were examined in Study 3, above). This investigation was designed in part to ascertain the developmental experiences that propelled top math/scientists to secure admission to some of the world's best graduate training programs. Because math/science disciplines contain a greater proportion of males relative to females, we over sampled the women to obtain sufficient numbers for confident generalizations. Never before has a large sample of women of this scientific caliber been psychologically profiled this extensively. Their experiences and thoughts afford critical information for future educational planning. The aspect of their development that is perhaps most striking is psychological similarity between male and female scientists (see Lubinski, Benbow, et al., 2001). Here, however, we focus on their educational experiences in comparison to age-equivalent SMPY participants (Table 5) and their unique experiences (Table 6).

Table 5 reveals that approximately 90% experienced some form of acceleration: 60% took advanced subject-matter placement, 66% took AP exams for college credit, 33% took college courses during high school, and 12% skipped grades. Over 78% reported a positive educational accelerative experience, whereas less than 2% reported negative experiences. The lack of significant sex differences in these data is truly remarkable.

Table 6 reveals that this sample desired opportunities to develop advanced academic skills at an early age, and worked to make such opportunities happen. These data point to ways to develop extraordinary academic talent. Again, it is remarkable that there are no significant sex differences. The information in Table 5 and Table 6 paint a clear picture. Specifically, at an early age, accelerative learning experiences were embraced by these truly exceptional students.

Summary of Empirical Findings

Overall, these four studies paint a clear picture. Being responsive to individual differences in learning rates facilitates achievement and learning, and the subjective impressions of intellectually precocious participants who experienced such opportunities view them positively well into adulthood. Indeed, when the curriculum moves at a slow pace, boredom and discontent frequently ensue. Intellectually precocious students who experience educational acceleration in middle school and high school view their pre-college educational experiences much more positively than their intellectual peers who were deprived of such experiences. Moreover, for developing world-class scientific leaders, such experiences appear to be critical. But these experiences are conducive to achieving extraordinary distinction in other intellectually demanding domains as well. In working with special populations, all interventions — as well as all decisions not to intervene — engender positive and negative effects, yet the evidence reviewed here strongly suggests that the former far outweigh the latter. Having said this, a brief mention of some things that could contribute further refinement to educational acceleration is in order.

Some Omitted Aspects

An important corollary found in this line of work is the magnitude of psychological diversity found within intellectually precocious populations across both intellectual and nonintellectual attributes relevant to academic and occupational content. Evidence suggests that by taking these aspects of individuality into account, the positive findings on acceleration uncovered herein, and in other reports (Heller, et al., 2000; Kulik & Kulik, 1984; Southern, et al., 1993), could be enhanced. First, current practices are not identifying certain populations of intellectually precocious youth who would profit from accelerative learning experiences (e.g., those talented in spatial visualization); but methods are available to identify these students at an early age so they do not fall through the cracks (Gohm, et al., 1998; Humphreys, et al., 1993; Shea, et al., 2001). This probably constitutes the largest source of talent missed by modern talent searches.

Second, affective and conative factors need to be attended to as well. Non-intellectual personal attributes, such as interests, values, and time willing to study and work, are critical for effective educational-vocational counseling (Dawis, 1992, 2001; Lubinski & Benbow, 2001), the implementation of accelerative educational opportunities, and the scientific study of the developmental trajectory of intellectual precocity (Achter, et al., 1999; Lubinski & Benbow, 2000; Schmidt, et al., 1998; Webb, et al., 2002). These relatively neglected aspects of individuality are important to be vigilant of in research and practice associated with educational acceleration. Being responsive to all educationally and vocationally relevant personal attributes can only enhance learning and achievement as well as the subjective evaluations of accelerative educational opportunities designed for precocious youth. A full explication of these ideas, however, is beyond the scope of this chapter (but see Lubinski & Benbow, 2000).

Concluding Statement

The findings reviewed here belong to a broader class of aptitude by treatment interactions (ATIs). In his famous APA Presidential address, Cronbach (1957) scolded differential psychologists for focusing too exclusively on variation among people and, simultaneously, he criticized experimentalists in a similar tone for only concerning themselves with variation among treatments. Cronbach (1957) stressed the need to assign different treatments (learning opportunities) to different people based on their individuality (Corno, Cronbach, et al., 2002; Cronbach, 1996; Cronbach & Snow, 1977). For optimal intervention, both personal attributes and environmental attributes need to be aligned. This idea is now widely accepted.

In the present context, because of the rapid rate at which intellectually precocious students learn abstract material, the curriculum needs to move at a pace well beyond normative expectations. Just as the pace of the curriculum needs to be adjusted for students challenged by developmental delays, the curriculum needs to be accelerated for precocious learners (relative to the norm). This practice has been called *appropriate developmental placement* (Lubinski & Benbow, 2000): adjusting the curriculum at a pace commensurate with student learning. This ATI is relevant to all students, because learning is optimally facilitated when the curriculum moves with the speed at which students learn.

Orchestrating developmentally appropriate ATIs for intellectually precocious youth requires multidimensional assess-

ment. This includes the cognitive abilities useful for selection and setting expectations, ability level and pattern configuration for ascertaining strengths (and relative weaknesses), and individual differences in nonintellectual personal attributes. Moreover, the student body also needs to be taken into account, because peers are important. Peers influence almost all learning environments and engender a wide range of harmful to helpful effects. Treatments conducive to a constructive classroom atmosphere for some students foster destructive behaviors in others: learning environments that move too quickly frustrate, whereas those that move too slowly result in boredom. Heterogeneity in student readiness within the same classroom ensures boredom or frustration or both. (These outcomes are ATIs as well.) The range of student readiness in classroom situations should not be left to chance. For classrooms to be somewhat responsive to each student's individuality, a degree of homogeneous grouping by competence is critical. To optimally teach students, we must first learn who they are by assessing individual differences relevant to their *passion* (or needs and interests, for commitment) and their *potential* (or abilities, for growth); following this, opportunities responsive to their individuality must be provided. Perhaps what needs to be stressed most is that appropriate developmental placement is important for *all students* (cf. Humphreys, 1985), not just the gifted. Appropriate developmental placement is predicated on the idea that one size will never fit all, and it has accrued a vast amount of empirical and practical support.

Over 40 years ago, Gordon Allport (1960), an early protagonist to the modern-day positive psychology movement (Seligman & Csikszentmihalyi, 2000), was keenly aware of the need to embrace individual differences in cognitive ability for determining optimal learning environments for intellectually precocious youth:

> *It is my own conviction that most of our institutions of higher learning offer intellectual fare distressingly below the digestive capacity of the gifted. I am not thinking merely of colleges that offer frivolous courses in fudge-making, but of our "best" institutions, where courses are often repetitive, routine, and devoid of challenge. Perhaps from the point of view of the average student they are adequate, but they stretch no nerve with the gifted student.... Usually such a student does well, and the teacher rejoices, but in many cases the teacher should feel less joy than guilt, for he has, unintentionally, beckoned the gifted student downward toward mediocrity rather than upward toward maximum self-development. (Allport, 1960, p. 68)*

Perhaps Julian C. Stanley (2000) was drawing on the wisdom of his advisor (Allport) when, 40 years later, he crafted, "Helping students learn only what they don't already know." Motivating Ceci (2000, p. 247) to remark, "In the media coverage of this debate [on intellectually precocious youth], I have never heard responses to the kind of examples Stanley [2000] gives, yet we know that such children exist, and in nontrivial numbers, too."

An appraisal from arguably the most distinguished counseling psychologist of the twentieth century, Leona E. Tyler (1974), taken from her brilliant treatment of *Individual differences: Abilities and motivational directions*, tells a similar story:

> *[I]n our haste to abolish the unjust and the obsolete, we cannot afford to ignore the psychological realities that generated such systems in the first place. There are highly significant psychological differences among individuals, and the soundness of our social institutions depends upon how successfully we take them into account.... A complex society cannot regard its members as identical interchangeable parts of a social machine. Its complex functioning depends upon the contributions of individuals specializing along different lines, equipped for carrying out different specialized tasks. For this reason we must not be content with any system of universal education that provides identical treatment for all pupils. We must look for ways of diversifying education to make it fit the diverse individuals whose talents should be developed and utilized (pp. 6–7).*

I hope that this volume is successful in responding to Allport's (1960) observations, and putting Tyler's (1974) wisdom, and the wisdom of other distinguished psychological scientists (Hobbs, 1951, 1958; Paterson, 1957; Pressley, 1955, 1967; Seashore, 1922; Stanley, 2000; Terman, 1954; Thorndike, 1927; Williamson, 1965), into broad practice.

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