2

Fostering Exceptional Development in Intellectually Talented Populations

John A. Achter
Concordia College—Moorhead

David Lubinski
Vanderbilt University

This chapter focuses on the evolution of theory, empirical knowledge, and practice on the optimal development of exceptional intellectual abilities. We are pleased and honored to contribute to a volume on positive psychology that highlights the contributions of counseling psychology. The scientific study of identifying and nurturing intellectual giftedness, although not consistently given priority nor always regarded in a positive light by society over the past 100 years, is one of the earliest examples of positive psychology (Seligman & Csikszentmihalyi, 2000). It deserves a prominent place in any review of this topic. Like their colleagues in other areas of applied psychology, counseling psychologists have contributed richly to uncovering antecedents to the development of extraordinary human accomplishment. The future promises a continuation of this trend. By any reasonable standard for practice based on science, this tradition of talent identification and development constitutes one of applied psychology's major success stories

(Benbow & Stanley, 1996; Lubinski, 1996; Lubinski, Webb, Morelock, & Benbow, 2001).

Applied psychologists in general (Paterson, 1957; Viteles, 1932), and counseling psychologists more specifically (Dawis, 1992; Tyler, 1974, 1992; Williamson, 1965), have an impressive history of quantifying human abilities and preference dimensions, and using this information to help people focus their development in directions that enhance life success and happiness. These two concepts, success and happiness, go by other names—competence and fulfillment, satisfactoriness and satisfaction—and embody two of the most important classes of personal attributes studied in applied psychology: abilities and preferences, respectively. For helping people select opportunities for positive development, abilities (capabilities) and preferences (motives) have received more applied-psychological attention than any others. This two-part emphasis can be seen in the prefaces to two landmark publications: E. K. Strong's (1943) *Vocational interests of men and women*, and Donald Super's (1949) *Appraising vocational fitness*. The application of knowledge regarding these personal attributes to the field of talent development has played a major role in guiding the identification and nurture of intellectual precocity for nearly 100 years.

This chapter concerns the exceptional development of intellectual talent and is organized into two broad sections: historical and modern contributions. First, we provide a historical overview of the major people and ideas moving the scientific study of intellectual talent forward over the past 100 years. Second, building on this, we review key empirical findings from recent decades in the context of implications for educational and counseling practice today. Within this discussion, we summarize a theoretical model for organizing contemporary research. Finally, we close with a summation of current knowledge and offer some future research directions. The need for more scientific knowledge on truly exceptional forms of achievement, creativity, and lifelong learning is underscored. This knowledge is likely to come from more complete understandings of the personal attributes characterizing intellectually precocious populations and the environmental provisions that catalyze their talents to full fruition.

HISTORICAL OVERVIEW: APPLIED PSYCHOLOGY'S CONTRIBUTIONS TO TALENT DEVELOPMENT

Several writers date the origins of systematic thinking about nurturing intellectual ability to Plato (trans. 1945), sometime around 400 B.C., when in *The Republic*, he advocated for early talent identification in order to conserve talent and educate future leaders. It wasn't until over 2000 years later, in the late 1800s, that standardized empirical methods for measuring intellectual functioning revolutionized the way such talent is identified. Leta Hollingworth (1926), a widely recognized pioneer in the development and education of profound intellectual giftedness, credits Galton (1869) with first showing that intellectual ability follows a normal distribution. However, not until the advent of intelligence testing, with Binet and Simon (1905), did scientifically significant efforts to identify gifted children begin in earnest.

For almost a century, applied psychologists have articulated the importance of attending to the needs of persons of high intellectual capacity. They have persevered through fluctuating social attitudes that have run the gamut from uninterested or antagonistic, to quite supportive during brief "crisis" periods (e.g., the Sputnik launch in 1957). Three common myths about the gifted have persisted throughout this time, and are still evident today: (a) the gifted can be anything they want to be in life, (b) they will find their own way to successful and satisfying careers without much assistance, and (c) they have so much already, it is elitist to give them more. During a hopeful period early in the 20th century, O'Shea (1926) wistfully noted, in the editor's introduction to Hollingworth's (1926) seminal work, *Gifted Children: Their Nature and Nurture*,

> The present writer can easily recall the time when everyone thought that 'bright' children could look out for themselves—as a result of which opinion they were neglected, in the schools at any rate, in order that teachers might devote all their energies to the less able. (p. xii)

Unfortunately, nearly identical sentiments have required countervailing efforts over subsequent decades by scientists and practitioners working with intellectually talented populations (cf., Benbow & Stanley, 1996; Hobbs, 1951; Pressey, 1949, 1967; Stanley, 1974, 1996; Terman, 1954; Tyler, 1965, 1992; Williamson, 1965).

Throughout this chapter, we hope to review some of the arguments and empirical data that challenge these myths. First, the intellectually gifted cannot necessarily be anything they want to be; rather, their unique combinations of specific abilities, interests, motivation, and environmental support make some paths of development more suitable than others. Second, gifted children do not always find their own way; rather, they are more likely to achieve at exceptional levels when given appropriate educational and environmental opportunities, and are at risk for underachievement when

not given such opportunities or when their unique abilities and preferences are not identified. Third, and related to the previous two points, attending to the unique needs of the intellectually talented benefits not only talented students, but also society as a whole when these individuals grow up to apply their realized abilities toward the challenges and needs of the world.

A practical implication of the perpetuation of these myths is that educators, counselors, and policy makers have often disregarded the need for special attention or unique opportunities for this population, and instead have dedicated the bulk of attention and resources to those with identified deficits whose needs are perhaps more obvious. Yet, like all special populations, the intellectually talented have unique needs that require special attention. This imbalanced focus on deficit versus strength mirrors another historical imbalance in psychology, that of remediating pathology versus building on human assets. Of course, a focus on strengths, a longtime defining emphasis of counseling psychology (Gelso & Fretz, 1992), exemplifies the present-day positive psychology movement (Seligman & Csikszentmihalyi, 2000).

A great counseling psychologist and advocate for the intellectually talented, Sidney Pressey (1955), recognized the deficit-strength imbalance several years ago. Using his own positive psychology language, he called for research into the concept of "furtherance"—that which facilitates or enhances full development of talent and personality—to complement existing research into "frustration"—that which detracts from personality or competence. This concept of furtherance provides an appropriate lens for reviewing the contributions of psychologists interested in talent development during the past century.

Pioneers and Proponents

In her careful studies and schooling of children manifesting profoundly high IQs (180+), whom she admiringly labeled "fortunate deviates," Hollingworth (1926, 1942) discerned many of the topics considered today as important for nurturing high talent. She recognized, for instance, that traditional education, formulated to suit the majority of students in the average range of intellectual functioning, was inadequate for the gifted because it left them without enough challenging and interesting work (Hollingworth, 1942). Students tended to become bored and disengaged with the traditional lockstep, age-based curriculum. According to Hollingworth (1926), an appropriate response was to allow gifted students "to traverse the established curriculum at a pace that will keep them occupied" (p. 273), a strategy often referred to as "acceleration," but which might be more accurately called "appropriate developmental placement" (Lubinski & Benbow, 2000). Hollingworth argued that students should be instructed according to their level of competence rather than their chronological age.

Hollingworth was a strong advocate for identifying intellectual talent at young ages, setting the stage for what might be called an epidemiology of positive development—identifying populations "at promise" for remarkable accomplishments (in contrast to "at risk" for negative outcomes; cf. Lubinski & Humphreys, 1997). Hollingworth (1926) recognized that to facilitate optimal intellectual development, personal qualities beyond intelligence must also be taken into account. She was an advocate, for example, of paying attention to the early interests of gifted children, "for it is known that attitudes and ideals formed in childhood have an important influence in shaping the life that follows" (p. 140). Her belief about the importance of childhood interests has only recently been subjected to empirical study, and has been supported (Achter, Lubinski, Benbow, & Eftekhari-Sanjani, 1999; Schmidt, Lubinski, & Benbow, 1998).

As one of the first to apply standardized intelligence tests to identify and study the upper range of the normal distribution, Hollingworth (1942) added much to early knowledge about intelligence. By studying her gifted students longitudinally, for instance, she documented the stability over time of measured intellectual functioning as relative status in a population. She, thus, set the stage for subsequent research revealing the power of intelligence in predicting educational achievement (Benbow & Stanley, 1996; Murray, 1998) and career success (Lubinski, 2000; Schmidt & Hunter, 1998) over the lifespan. Among her many important contributions as a pioneer in the psychology of women, Hollingworth (1926) also documented the equality of women and men in general intelligence, countering the long-held myth that females were intellectually inferior to males. This landmark finding surely helped open the doors to greater attention to and opportunities for females in school and work.

A contemporary to Hollingworth, Lewis M. Terman, is probably the most recognized 20th century figure in the study of intellectual talent. Terman's (1925–1956) ambitious longitudinal study of 1528 high IQ (140+) children from Age 11 through adulthood is still in operation today. (Holahan, Sears, & Cronbach, 1995). Curiously, Terman (1954; Terman & Oden, 1947) initially was a skeptic regarding the needs of the gifted. He had internalized the prevailing sentiment of the early 1900s, "early ripe, early rot," which supposed that child prodigies tended to develop either emotional or

intellectual deficiencies in adulthood. His subsequent research not only disproved this myth, but also provided a solid foundation for much of what we know today about the physical and psychological development of gifted persons over the lifespan, which more recent studies with better controls have confirmed (Benbow, Lubinski, Shea, & Eftekhari-Sanjani, 2000; Lubinski, Webb, et al., 2001; Lubinski & Humphreys, 1992). Like Hollingworth, Terman (1954; Terman & Oden,1947) promoted the use of both curriculum acceleration and enrichment to adequately meet the needs of the gifted. For more than 30 years he documented the undeniable success of most of his study's participants; Terman's work also substantiated the great predictive power of general intelligence (Terman, 1954; Terman & Oden, 1959)—now among the most robust and well-known generalizations in applied psychology (Campbell, 1990; Schmidt & Hunter, 1998).

Like Hollingworth, Terman (1954) also recognized early on that high intelligence alone did not produce high levels of accomplishment. He discovered that, although high IQ had predictive power *on average* across achievement domains for his select group, it could not perfectly distinguish between individuals who would and would not become successful, nor suggest what direction success might take. He acknowledged the importance of both "special aptitudes" and interest patterns in determining the developmental trajectory of those with high general intellectual ability, and used early versions of the Strong Interest Inventory to study the latter, with good predictive success (Terman & Oden, 1947). He also highlighted factors such as drive to achieve, social adjustment (Terman & Oden), persistence, self-confidence (Terman & Oden, 1959), and a stable and supportive family background (Terman, 1954) as intellectual facilitators because they helped distinguish between high-achieving and low-achieving persons in his high IQ group. All of these nonintellective factors have remained of interest to modern researchers (cf., Ericsson, 1996; Eysenck, 1995; Gardner, 1993; Lubinski & Benbow, 2000; Simonton, 1999), and some of them will be discussed later in this chapter.

An underappreciated contemporary of both Hollingworth and Terman was Carl Emil Seashore. His 28-year post as Dean of the Graduate College at the University of Iowa (1908–1936), and his position as Dean of the Graduate College *pro tempore* (1942–1946) at the same institution, prevented him from the kind of recognition enjoyed by others, partly because he had no students to help in disseminating his writings. Yet, Seashore's (1922) classic publication in *Science*, "The Gifted Student and Research," and his contributions to *A History of Psychology in Autobiography* (Seashore, 1930) and *Pioneering in Psychology* (Seashore, 1942; see especially his treatment of gifted students, pp. 193–199), are still very much worth reading. Seashore (1922) recognized that identifying gifted students at a young age capitalizes on the enthusiasm, motivation, curiosity, and criticism that mark this period in life, and he proposed educational reforms to better attend to the unique educational needs of talented youth. He comprehended well the needs of the gifted and articulated a concise educational philosophy applicable to students at all ability levels: "Keep each student busy at his highest level of achievement in order that he may be successful, happy and good" (p. 644). This philosophy is consistent with the individual differences tradition in psychology (Tyler, 1974; Williamson, 1965).

Another important counseling psychologist working from the individual differences tradition was E. G. Williamson (1939), who like Seashore, promoted the needs of intellectually talented individuals by calling for early identification and flexibility in the curriculum (including acceleration). Early on, Williamson commented that "genius does not always find its own way" (p. 387), and charged counselors with the responsibility of discovering gifted students, assessing the degree and pattern of their talents, and assisting them in achieving "optimum success and satisfaction" (p. 128). Like Seashore (1922), Williamson stressed intellectual comradeship in the counseling of intellectually talented youth. In *Vocational counseling: Some historical, philosophical, and theoretical perspectives* (Williamson, 1965), he outlined methods for accomplishing this through the modification of learning environments in accordance with students' rates of learning.

Strikingly similar echoes of Seashore and Williamson are found in Sidney Pressey's mid-20th century publications (Pressey, 1949, 1967). He published widely, in outlets like the *American Psychologist* and *Science* (Pressey, 1946a, 1946b), on the benefits of educational acceleration (while also urging care in guarding against social maladjustment). As noted previously, he advanced the concept of "furtherance" (Pressey, 1955) as a framework for cultivating promising young scholars and scientists and helping them become adults who make outstanding contributions to their disciplines and to society. In drawing an analogy to talent development in music or athletics, he observed that "early encouragement, intensive instruction, continuing opportunity ... a congruent stimulating social life, and cumulative success experiences" (p. 126) mark the lives of those who become eminent in their fields.

Attendant with these mid-century contributions, Paul Witty (1951) edited an important volume entitled *The Gifted Child*, to which one of Pressey's students, Nicholas Hobbs (1951), contributed. Witty commented that talented children and youth are "society's richest but most neglected

resource" (p. 209), and challenged educators to "divest themselves of the belief that gifted students can get along by themselves and that it is undemocratic to give them special education suited to their particular needs" (p. 275). Picking up on this idea, and adopting a more activist tone, Hobbs also spoke out in defense of the needs of the intellectually gifted, stating,

> To develop a most vigorous democracy we must avoid the deadening mediocrity that arises when equality is interpreted to mean that people must all be alike .... Not only must we avoid this leveling tendency, we must actively seek full expression of the differences between people, with a deep respect for the right of people to be themselves. (p. 170)

In his classic article, "The compleat counselor," Hobbs (1958) asserted that counselors have a responsibility to facilitate the development of high intellectual potential.

Our next historical figure, Leona E. Tyler, is arguably the most renowned counseling psychologist of the 20th century. In the peak of her career, she had the most popular texts in both counseling (Tyler, 1953) and individual differences psychology (Tyler, 1965). Earlier in her career, she also worked on Terman's longitudinal study.

An important shift in the direction of talent development research was noted in the 1960s. Tyler (1965) observed that until this time, the study of individual differences was nearly synonymous with the study of general intelligence (cf., Jenkins & Paterson, 1961). The shift was toward recognizing and studying "special talents" in addition to general ability. As previously noted, both Terman (1954; Terman & Oden, 1947) and Hollingworth (1926) recognized that several dimensions of individual differences contributed to the fulfillment of intellectual promise but, at the time, "with regard to testing for special talents, psychological technique has not advanced so far" (Hollingworth, pp. 32–33). Tyler (1965) pointed out that, although specific intellectual abilities are fairly highly correlated with one another and their communality isolates the construct of general intelligence, these correlations are not perfect. Enough variability exists to identify individuals with tilted ability profiles. For instance, referencing data from Project TALENT, a longitudinal study of over 400,000 high school students (Flanagan & Cooley, 1966), Tyler (1974) reported that 16% of students entering college scored above the 90th percentile on a test of general aptitude, but 35% scored in this range on one or more of the specific abilities (quantitative, scientific, or technical) assessed. Tyler, thus, demonstrated that the landscape of differential intellectual potential is vast (cf., Humphreys, Lubinski, & Yao, 1993). Our final historical figure, Julian C. Stanley, systematically exploited that differential potential.

Likely the most notable psychologist in the late 20th century to study intellectually precocious youth is Julian C. Stanley. With his Study of Mathematically Precocious Youth (SMPY) research and service program, initiated at Johns Hopkins University in 1971, Stanley advocated for the widespread use of above-level testing of specific abilities to identify intellectually precocious young adolescents (Keating & Stanley, 1972; Stanley, 1977). Stanley and his colleagues were the first to systematically use college entrance exams (e.g., SAT, ACT) to differentiate levels of ability in both math and verbal domains for gifted adolescents (Ages 12–14). By raising the ceiling of test difficulty, above-level ability testing produced a greater spread of scores among students who had reached the measurement limits on in-grade school achievement tests, thereby distinguishing the able from the exceptionally able and the superbly able in a given domain. Such testing has given talented students, and their parents, teachers, and counselors a clearer picture of students' exceptional intellectual strengths, as well as their relative weaknesses. This valuable information cannot be gleaned from high-flat performance on grade-level achievement tests or a test of general intelligence; methods that, when used exclusively, contribute to misperceptions of multipotentiality among the intellectually talented (Achter, Benbow, & Lubinski, 1997; Achter, Lubinski, & Benbow, 1996).

Stanley and colleagues have documented nearly 30 years of success in using above-level ability testing to tailor differential educational programming to enhance academic achievement and personal adjustment (Benbow, 1991; Benbow & Stanley, 1996; Stanley, 2000). By successfully applying new methods for early identification and for measuring specific abilities, Stanley further validated the unique needs of intellectually precocious students that early pioneers expressed (in particular, Hollingworth, Pressey, Seashore, Terman, Tyler, & Williamson). In fact, Stanley's work is perhaps the best exemplar to date of an applied psychological enterprise for facilitating what Pressey (1955), whom Stanley knew personally, called "furtherance."

This concludes our brief overview of early protagonists and the applied psychological work they have contributed to this important sphere of human capital. Some of the most distinguished applied (including counseling) psychologists of all time helped in developing the area of talent development. Indeed, four of the historical figures outlined previously served as American Psychological Association presidents: Seashore (1911), Terman (1923), Hobbs (1966), and Tyler (1973). We recommend reviewing the

original sources cited in this chapter for a richer appreciation of the trends developed and encouraged by our predecessors. Collectively, the work of these early pioneers revealed the existence of a vast amount of quantitative and qualitative potential in this special population, highlighting the fact that although the gifted are distinguished by their *general* intellectual capacity, they are not a categorical type. It is not surprising that the individual differences tradition in counseling psychology—with its appreciation for within-group variability, emphasis on individual assessment, and sensitivity to idiographic detail (Dawis, 1992)—found the study of intellectually gifted populations fascinating for applying its measurement tools, theories of human development, and penchant for social advocacy. The trends reviewed previously and the empiricism supporting their psychoeducational significance are important to keep in mind, not only for understanding where we are at today, but also for gaining a purchase on ways to accomplish constructive advances.

MODERN EMPIRICAL ADVANCES

Thanks to the groundwork established by many early individual-differences investigators, modern methods of synthesizing empirical studies have produced key psychological advances that promote the optimal development of intellectual talent. Contemporary findings have improved our understanding of the antecedents to educational and vocational choice, and of performance after choice (Dawis, 2001). In particular, we now have a much better understanding of the major interest dimensions (Day & Rounds, 1998; Holland, 1996) and their contribution to educational–vocational choice (Lubinski, 2001; Savickas & Spokane, 1999); we also possess a better understanding of human-intellectual abilities (Carroll, 1993) and their contribution to the level of educational–vocational achievement and work performance (Gottfredson, 1997; Schmidt & Hunter, 1998).

Over the past 30 years, these advances have contributed to a marked escalation of knowledge regarding the psychological nature and correlates of intellectual precocity, which have, in turn, enhanced gifted education. What has accrued in the study of intellectually talented youth blends seamlessly with the modern advances on the nature and organization of cognitive abilities (Carroll, 1993), educational–vocational interests (Day & Rounds, 1998; Holland, 1996), and more encompassing theoretical models of positive psychological development (Ackerman, 1996; Ackerman & Heggestad, 1997; Lubinski, 2000; Lubinski & Benbow, 2000) based primarily on the study of heterogeneous adult populations. The utility of applying these individual differences concepts to studying and understanding intellectually precocious youth supports the idea that intellectual giftedness among youth is best construed in terms of precocity, or development that is advanced for its age (Benbow & Stanley, 1996).

The Contributions of SMPY

As noted previously, elements of many contemporary advances may be traced to Stanley's work, whose longitudinal study of precocious youth, SMPY, significantly changed the landscape of gifted education. At a time when many social scientists were following Kuhn's (1962) recommendations for scientific revolutions, by jettisoning the "normal science" of their disciplines and purporting "paradigm shifts," Stanley (1974, 1996; Keating & Stanley, 1972) built on the work of earlier applied psychologists to reach new heights.

Stanley did not reject what the construct of general intelligence had to offer gifted education. Rather, he assimilated this powerful dimension of psychological diversity and then extended the psychometric approach to major group factors for identifying and developing more specific intellectual strengths. Because of his interest and experience in identifying and developing scientific talent, Stanley began in 1969 by studying mathematical reasoning ability (Keating & Stanley, 1972; Stanley, 1973, 1974). However, by 1980, SMPY was devoting an equal amount of attention to verbal reasoning ability (Stanley, 1996). To study long-term outcomes and the development of talent across the lifespan, SMPY—now based at Vanderbilt University—is currently tracking over 5000 intellectually precocious youth identified through talent searches by Age 13 as being in the top 1% in verbal or mathematical reasoning ability (Lubinski & Benbow, 1994; Stanley, 1996). The remainder of this chapter will focus on research findings from SMPY, as this is one of the largest contemporary studies of intellectual talent, and the one with which we are involved and most familiar.

Identifying intellectually precocious youth through assessment tools initially designed for college-going high-school seniors is one of applied psychology's most impressive contributions to the conservation and development of human talent to date (Benbow et al., 2000; Benbow & Stanley, 1996; Lubinski, 1996, 2000; Lubinski, Webb et al., 2001; Stanley, 1954, 1990, 2000; Webb, Lubinski, & Benbow, 2002). The assessment of gifted youth at Ages 12 or 13 using above-level tests such as SAT–Math and SAT–Verbal produces an ability profile that is quite diagnostic (Benbow & Lubinski, 1996; Benbow & Stanley, 1996). For example, researchers at

SMPY have observed that many intellectually talented individuals exhibit differential strengths in either mathematical or verbal reasoning in adolescence (Achter et al., 1996). Over time, these differential areas of strength forecast the selection of contrasting educational and career paths (Achter et al., 1999; Lubinski & Benbow, 2000; Lubinski, Benbow, Shea, Eftekhari-Sanjani, & Halvorson, 2001; Lubinski, Webb, et al., 2001). This information can meaningfully influence practice. Educators and counselors equipped with this specific ability information can differentially plan educational programs that are developmentally appropriate for bright youth.

Over the last 10 years, particularly compelling evidence also has documented the importance of assessing personal attributes beyond abilities in this special population, just as Hollingworth and Terman anticipated. Among intellectually precocious young adolescents, conventional preference questionnaires initially designed for adults have revealed marked individual differences (Achter et al., 1996), stability over 15- and 20-year-intervals (Lubinski, Benbow, & Ryan, 1995; Lubinski, Schmidt, & Benbow, 1996), and construct (including predictive) validity (Achter et al., 1999; Schmidt, Lubinski, & Benbow, 1998). The assessment of preferences in an above-level format can help educators and counselors refine recommendations to gifted youth by highlighting applications of talent that could maximize satisfaction.

Positive findings underscoring the importance of diverse intellectual and nonintellectual attributes have required a multidimensional model for conceptualizing talent development—one that insists on more comprehensive assessments on which to base longitudinal inquiry, applied practice, and the design of more optimal learning environments for gifted youth. The model utilized by SMPY is the Theory of Work Adjustment (Dawis & Lofquist, 1984; Lofquist & Dawis, 1991).

Theoretical Underpinnings: Person–Environment Fit and the Theory of Work Adjustment

For nearly a century, psychological approaches to person–environment fit (PE fit; Rounds & Tracey, 1990) have strived to understand the process of career choice. The Theory of Work Adjustment (TWA) is a modern-day descendent of work dating back to Parson's (1909) *Choosing a Vocation*, which inspired the articulation of trait-and-factor theory in vocational psychology (Paterson, 1957; Williamson, 1939), the foundation of TWA. Roe's (1956) pioneering framework linking personal characteristics (interests & abilities) to work environments is also squarely centered within this tradition, as is Holland's (1985, 1996) Congruence Theory. Yet, TWA is arguably the most comprehensive PE fit theory today. Although it was initially developed to conceptualize work adjustment in adult populations, TWA has broader implications ranging from educational to industrial psychology (Lubinski, 2000). Lubinski and Benbow (2000) have extended its use to organizing the ability-preference findings from SMPY summarized previously, creating a multidimensional approach for conceptualizing talent development and lifelong learning.

According to TWA, optimal learning and work environments are defined by the co-occurrence of two broad dimensions of correspondence. The first is *satisfactoriness* (a match between ability & ability requirements) and the second is *satisfaction* (a match between preferences like interests & values & the rewards typical of contrasting learning & work environments). For further explication of this model, and how it connects with other theoretical frameworks for understanding ability (cf., Carroll, 1993) and interest dimensions (cf., Holland, 1996; Prediger, 1982), see Lubinski and Benbow (2000); for applied practice in gifted education, see Benbow and Lubinski (1997) and Lubinski and Benbow (1995). Fig. 2.1 contains a graphical representation of TWA (on the right) and its related ability and interest components (on the left) that help guide assessment of the person (or individual) side of the PE fit model.

Achter et al. (1999) reported longitudinal findings from SMPY in support of the TWA-based model for conceptualizing and promoting talent development. By showing that age-13 assessments on preference dimensions added incremental validity to age-13 assessment of mathematical and verbal abilities in predicting educational outcomes at age 23, this study documented the distinctive advantage of assessing both abilities and preferences when working with talented youth. Achter et al. administered the SAT and Allport, Vernon, & Lindzey's (1970) Study of Values (SOV) to 432 intellectually precocious young adolescents, and then surveyed them again 10 years later, after they had secured college degrees. College majors were categorized into three broad criterion groups: Math–Science, Humanities, and Other. The SAT mathematical and verbal measures accounted for 10% of the variance between these groups by themselves, and the five SOV scales accounted for an additional 13% of variance. Given the heterogeneity within these three broad degree-groupings, and considering that time-one assessment occurred at age 13, accounting for 23% of the variance was truly impressive.

Fig. 2.2 depicts discriminant analysis classification accuracy into the three criterion groups, based on both ability and preference dimensions. Note that discriminant loadings (contained in the structure matrix) support interpretation of distinct math–science and humanities dimensions, with math ability and theoretical values loading most strongly on Function

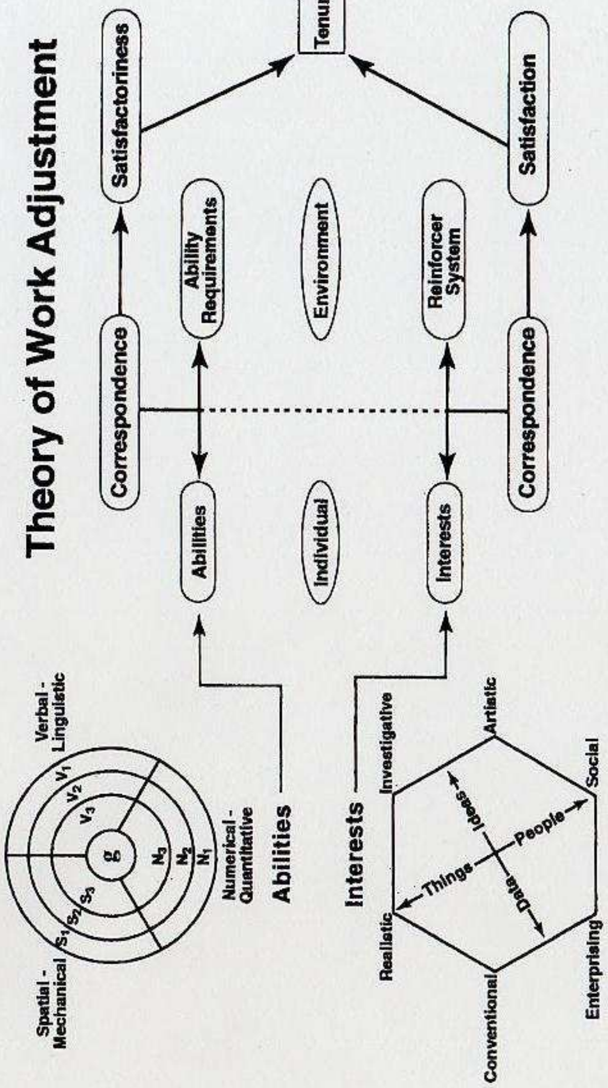

FIG. 2.1. The Theory of Work Adjustment (right) is combined with the radex scaling of cognitive abilities (upper left) and the Realistic, Investigative, Artistic, Social, Enterprising, Conventional (RIASEC) hexagon of interests (lower left) for conceptualizing personal attributes relevant to learning and work (Lubinski & Benbow, 2000). The letters within the cognitive ability arrangement denote different regions of concentration, whereas their accompanying numbers increase as a function of complexity. Contained within the RIASEC is a simplification of this hexagon. Following Prediger (1982), it amounts to a two-dimensional structure of independent dimensions: people–things and data–ideas, which underlie RIASEC. The dotted line running down the individual and environment sectors of Theory of Work Adjustment (TWA) illustrates that TWA places equal emphasis on assessing the personal attributes (abilities and interests) and assessing the environment (abilities requirements & reward structure).

Discriminant Function Structure Matrix

Variable	F1	F2
SAT-Verbal	0.09	0.56
SAT-Math	0.59	-0.12
SOV-Theoretical	0.87	-0.03
SOV-Aesthetic	-0.13	0.81
SOV-Social	-0.60	-0.01
SOV-Religious	-0.56	0.03
SOV-Economic	0.47	-0.29

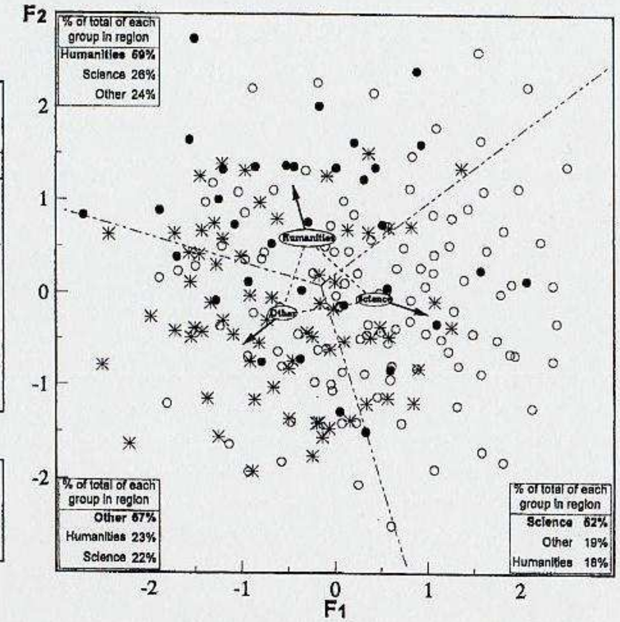

FIG. 2.2. Group centroids and discriminant-structure matrix (Achter et al., 1999). The bivariate group centroids for the total sample were (Function 1, followed by Function 2): Math–Science (.43, –.05); humanities (–.29, .60); and Other (–.57, –.21). To make the scatter plot less cluttered, each bivariate point represents an average of two participants' discriminant scores (most typically, the closest geometrically). Percentages were computed using all individual data points. SOV = Study of Values; SAT = Scholastic Aptitude Test; F1 = Function 1; F2 = Function 2.

1 (coupled with negative loadings for social & religious values) and verbal ability and aesthetic values loading most strongly on Function 2.

TWA's breadth encompasses several rich traditions that have served applied psychology well and have contributed greatly to the study of talent development. TWA continues to serve as a positive framework for conceptualizing studies of the SMPY cohorts.

Longitudinal Findings Emerging in the 21st Century

In the remaining pages, fresh longitudinal findings are presented, organized around three critical topics for understanding, assisting, and studying talent development: ability level, ability pattern, and ability underidentification. The TWA framework nicely organizes all of these findings.

Ability Level. The range of individual differences in human abilities is huge, and the magnitude of these differences is sometimes underappre-

ciated. Consider, for example, general intelligence. In terms of IQ points, scores within the top 1% on general intellectual ability range from approximately 137 to well over 200, a tremendous amount of quantitative variation among an already highly select group. The same is true for specific abilities. However, the question often asked is whether these differences in ability level make real-world differences in the lives of people. Or, to paraphrase the late Donald G. Paterson, (R. V. Dawis, Personal Communication, 2000), "Do these differences make a difference?" Recent longitudinal reports unequivocally reveal that they do.

Extending a study of quantitative differences in educational and career outcomes between gifted individuals in the top vs. the bottom quartiles of the top 1% in mathematical ability (Benbow, 1992), Lubinski, Webb, et al. (2001) studied an independent sample of 320 profoundly gifted individuals, identified for their exceptional (i.e., top 1/10,000) mathematical or verbal reasoning ability at Age 13 (M estimated IQ > 180). By Age 23, 93% of this group had obtained bachelor's degrees, 31% had earned master's degrees, and 12% had completed doctoral degrees. Furthermore, fully 56% of this select group expressed intentions to pursue doctorates, a number over 50 times the base rate expectation (viz., 1% in the general population, U.S. Department of Education, 1997). By comparison, studies of persons in the highly able, but less select, top 1% of cognitive ability have revealed pursuit of doctoral degrees at 25 times base rate expectations (Benbow et al., 2000)—still remarkable, but only half the rate observed among the top 1 in 10,000.

In addition, as impressive as this "difference that makes a difference" is, it does not tell the whole story regarding the magnitude of achievement in the higher ability group. For example, among those pursuing doctorates in the top 1 in 10,000 study (Lubinski, Webb, et al., 2001), 42% were doing so at universities ranked within the top 10 in the United States, another indication of the extraordinary promise of this group. By comparison, only 21% of the top 1 in 100 (Benbow et al., 2000) were pursuing doctorates at universities ranked in the top 10. An abbreviated listing of individual achievements attained by the top 1 in 10,000 group by Age 23 (see Table 2.1) further underscores the real-world significance of their ability level. It certainly appears that increased ability level translates into increased achievement among those in the top 1% (or the top ⅓ of the ability range), just as they do in the general population (Murray, 1998). It will be fascinating to observe the achievements and impact these highly talented individuals will have as SMPY tracks their lifespan development.

TABLE 2.1
Awards and Special Accomplishments of the Top 1 in 10,000 in Mathematical or Verbal Reasoning Ability

Sciences & Technology	*Humanities & Arts*	*Other*
Scientific publications (11)	Creative writing (7)	Phi Beta Kappa (71)
Software development (8)	Creation of art or music (6)	Tau Beta Pi (30)
Inventions (4)	Fulbright Award (2)	Phi Kappa Phi (14)
National Science Foundation fellowship (2)	Wrote proposal for a novel voting system for new South African Constitution	Entrepreneurial enterprises (2)
Designed image correlation system for navigation for Mars Landing Program	Solo violin debut (Age 13) Cincinnati Symphony Orchestra	Omicron Delta Kappa
The American Physical Society's Apker Award	Mellon Fellow in the Humanities	Olympiad silver medal
Graduated from Massachusetts Institute of Technology in 3 years at Age 19 (entered at 16) with perfect (5.0) grade point average and graduated from Harvard Medical School with MD at age 23	Presidential Scholar for Creative Writing	Finished bachelor's & master's in 4 years
Teaching award for "Order of Magnitude Physics"	Hopwood Writing Award	Received private pilot's license in 1 month at Age 17
	Creative Anachronisms Award of Arms	
	First place in midreal-medieval poetry	
	Foreign Language Study fellowship	
	International Predissertation Award	

Group	*Sciences & Technology*	*Humanities & Arts*
High-Math	16	5
High-Flat	6	6
High-Verbal	7	13

Note. Numbers in parentheses represent the number of participants indicating each accomplishment. All other entries represent a single individual , Lubinski, Webb et al. (2001).

Ability Pattern. Attention to the bottom right quadrant of Table 2.1 reveals another critical factor for understanding and nurturing talented youth: ability pattern. Lubinski, Webb, et al. (2001) divided their top 1 in 10,000 sample into three groups based on individual ability profiles. Two groups were *tilted* (either High-Math or High-Verbal) and one was more intellectually uniform or *flat* (High-Flat). The High-Flat group had SAT-Math and SAT-Verbal scores that were within one standard deviation of the other. The other two groups had contrasting intellectual strengths: the High-Math group had SAT-Math scores greater than one standard deviation above SAT-Verbal scores, whereas the High-Verbal group exhibited the inverse pattern. These three ability patterns, drawn from age 13 assessments, eventuated in distinct developmental trajectories (see next). These three phenotypic patterns also are being examined by the human genome project, seeking to uncover general, and specific genetic markers of human intelligence (Chorney et al., 1998; Plomin, 1999).

Lubinski, Webb, et al. (2001) compiled the idiographic accomplishments and awards shared in open-ended questions and placed them in one of three clusters: Humanities and Arts, Science and Technology, and Other (Table 2.1). They then went back to ascertain whether these three clusters were differentially representative of their three ability groups. Of those listing accomplishments in science and technology (see Table 2.1), three fourths were in the High-Math group. By comparison, two thirds of those listing accomplishments in the humanities and arts were in the High-Verbal group. High-Flat participants reported similar numbers of accomplishments in the sciences and humanities clusters. It is evident that ability pattern relates to the types of activities to which these individuals devoted time and effort. Moreover, differential course preferences among these three groups in high school and college anticipated these qualitative differences in achievement (see Fig. 2.3). The High-Math group consistently preferred math–science courses relative to the humanities, whereas the inverse was true for the High-Verbal group; results among the High-Flat group were, again, intermediate.

Other investigations on the longitudinal significance of ability pattern, using more comprehensive assessments, have generated even more refined predictions. For example, Shea, Lubinski, and Benbow (2001) tracked a group of over 550 individuals representing the top 0.5% in general intellectual ability over 20 years. They demonstrated that verbal, mathematical, *and spatial* abilities, assessed in early adolescence, were related in distinct ways to subsequent educational–vocational group membership in engineering, physical sciences, biology, humanities, law, social sciences, and business. Figures 2.4 and 2.5 highlight the configural ar-

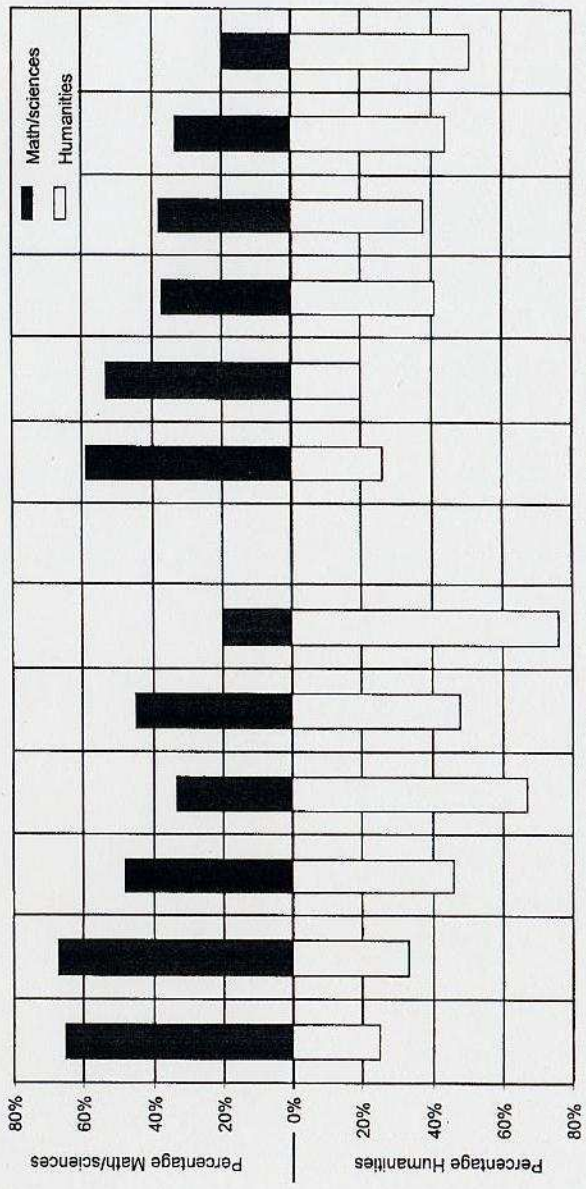

FIG. 2.3. *Participants' favorite course in high school and in college (Lubinski, Webb, et al., 2001). Percentages in a given column do not necessarily sum to 100% because only participants indicating either math–sciences or humanities courses are displayed. Significance tests for differences among groups for favorite course are as follows: High School Math–Sciences* $\chi^2_{(df=2)} = 20.7$, $P < .0001$; College Math–Science $\chi^2_{(df=2)} = 18.2$, $P < .0001$; High School Humanities $\chi^2_{(df=2)} = 36.6$, $P < .0001$; and College Humanities $\chi^2_{(df=2)} = 30.2$, $P < .0001$.

rangement of bachelor degree groups (Fig. 2.4) and occupations (Fig. 2 5) in three-dimensional space; organized by standardized units of mathematical (X-axis) and verbal (Y-axis) ability. For each grouping, the direction of the arrow represents whether spatial abilities (Z-axis) were above (positive value) or below (negative value) the grand mean for spatial ability. These arrows were scaled on the same units of measurement as the SAT scores, so one can envision how far apart these groups were in three-dimensional space as a function of these three abilities. As displayed in Figures 2.4 and 2.5, exceptional verbal ability, relative to mathematical and spatial ability, was characteristic of group membership in the social sciences and humanities; whereas higher levels of math and spatial abilities, relative to verbal abilities, characterized group membership in engineering and math–computer science. Other sciences appeared to require appreciable amounts of all three abilities. The findings were highly

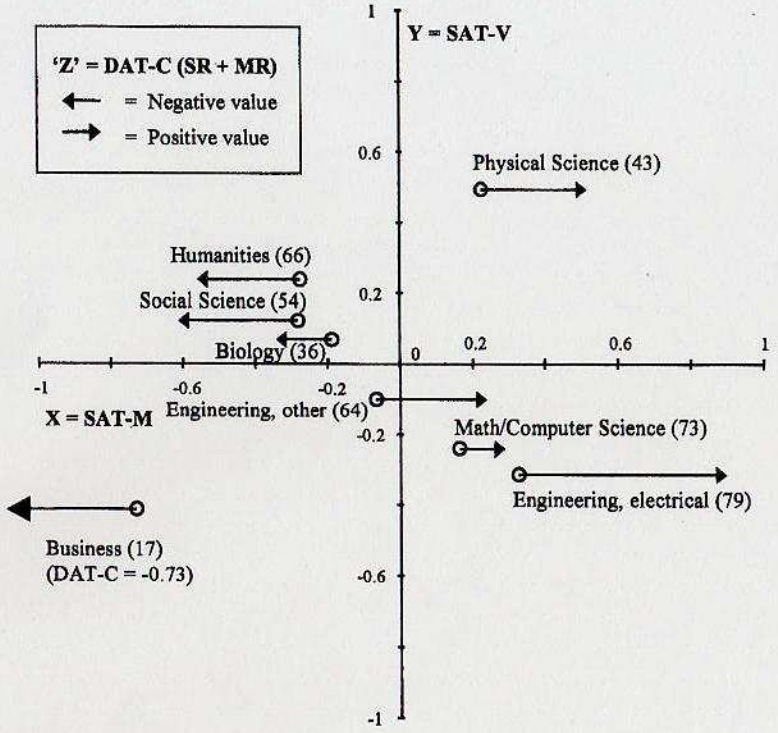

FIG. 2.4. Trivariate means for conferred bachelor-degree groups (Shea et al., 2001). Ability variables are scaled on a uniform metric. Group *N*s are provided in parentheses.

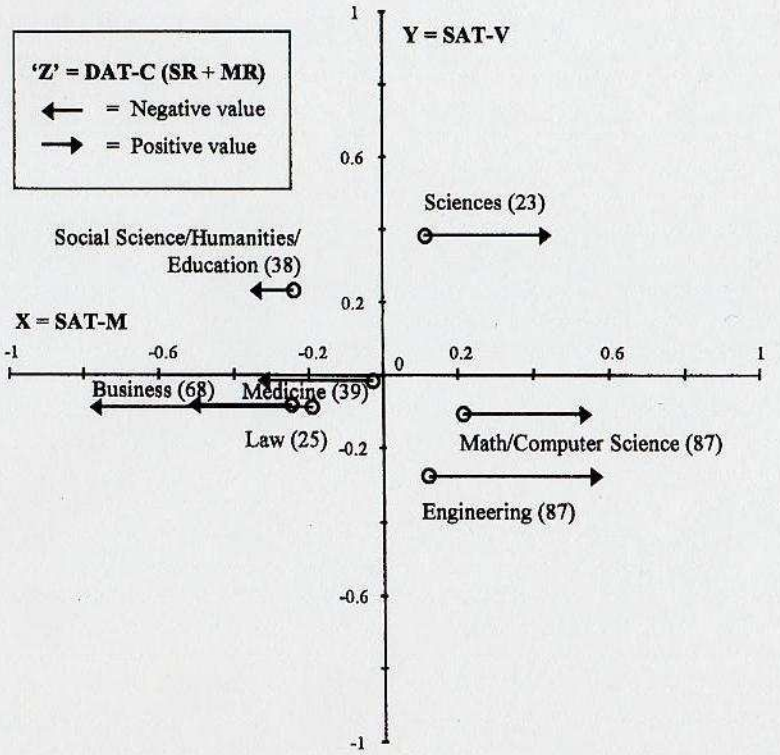

FIG. 2.5. Trivariate means for occupational groups at Age 33 (Shea et al. 2001). Ability variables are scaled on a uniform metric. Group *N*s are provided in parentheses. DAT-C = (Differential Aptitude Test - Composite); SR = (Space Relations); MR = (Mechanical Reasoning); SAT-V = (Scholastic Aptitude Test - Verbal); SAT-M = (Scholastic Aptitude Test - Mathematical).

consistent for other outcome criteria, including most- and least-favorite high-school class and graduate field of study (Shea et al., 2001).

Ability Under/Identification. The Shea et al. (2001) study was among the first to document the unique developmental implications of spatial ability among the gifted, further highlighting the importance of comprehensive cognitive ability assessments. As we strive not to miss those students who might usefully contribute to our increasingly technological society, identifying spatially talented individuals is one of the current critical challenges in the field. Indeed, using normal curve theory, it is estimated

that approximately half of the top 1% in spatial visualization are not identified by modern talent search procedures that focus only on mathematical and verbal talent. We are unaware of any greater loss of human capital than the neglect of this special population (cf., Gohm, Humphreys, & Yao, 1998; Humphreys et al., 1993; Humphreys & Lubinski, 1996). These students will not necessarily find their own way if their exceptional spatial talents are not recognized and encouraged.

It seems clear in reviewing modern findings that comprehensive ability and preference assessment among the intellectually gifted at an early age is useful in predicting both educational–vocational choice and level of success–achievement. The contemporary research supports and extends the work of pioneers dating to Terman and Hollingworth, highlighting the utility of early identification, attention to both general and specific abilities, the provision of developmentally appropriate opportunities, and the importance of nonintellective factors such as preferences. The research and service model guiding SMPY might also be regarded as reflecting furtherance (Pressey, 1955), in that talents and interests are identified early, are allowed to develop through appropriate educational opportunities, and eventuate in impressive (often highly precocious) outcomes. In the remaining section, we discuss ways to refine the accuracy of longitudinal predictions, and thereby enhance the specificity, comprehensiveness, and confidence of early educational and vocational counseling.

Future Directions: Other Factors Affecting Development

It is certainly true that the landscape of intellectual precocity is not one-dimensional—and the paths along which it develops involve some of the most intriguing psychological phenomena of the human condition (Ericsson, 1996; Eysenck, 1995; Galton, 1869; Gardner, 1993; Heller, Mönks, Sternberg, & Subotnik, 2000; Jensen, 1996; Simonton, 1988). Yet, even with the multidimensionality reviewed up to this point, something is missing. Among individuals who possess comparable ability and preference profiles, and who have been given commensurate opportunities, huge individual differences in achievement are routinely observed. We do not know all the causal determinants relevant to modeling individual differences in achievement and creativity. One class of causal factors, however, is often underappreciated by counselors and educators whose clientele comprises students working toward advanced degrees. These are the conative factors.

Since at least the time of Aristotle, attributes like capacity to work, industriousness, persistence, and zeal have been posited to contribute to individual differences in achievement outcomes. Modern theoreticians studying art, athletics, business, the military, politics, and science, among others, have repeatedly stressed these personal attributes of energy or psychological tempo (Ericsson, 1996; Eysenck, 1995; Gardner, 1993; Jensen, 1996; Simonton, 1988). Some persons seem to have great mental ability (e.g., high IQ), but appear to lack mental energy needed to use this ability. Probably part of the reason applied psychologists have not extensively discussed these determinants is that we do not have good measures of them. Yet, it is easy to surmise that they operate to explain significant variance in learning and performance. Indeed, it is likely that under- and overachievers are distinguished, in part, by this set of attributes.

Some modern theorists have discussed these attributes and have begun to develop measures for them, but we are still at a relatively primitive stage compared to our tools for assessing abilities and preferences. For example, Ackerman (1996) developed a measure for a construct he called, "typical intellectual engagement" (Goff & Ackerman, 1992). In addition, Dawis and Lofquist (1976, 1984) offered four aspects of "personality style" to characterize the temporal characteristics of behavior: celerity, endurance, pace, and rhythm. For both groups of investigators, concentrated effort, time on task, and energy invested play large roles in the development of knowledge structures and expertise.

To provide a glimpse in to the potential importance of these factors, Fig. 2.6 contains data from over 1700 participants from SMPY's 20-year follow up (Benbow et al., 2000; Lubinski & Benbow, 1994). All were assessed with the SAT before age 13, during the 1970s, and scored in the top 1% in quantitative reasoning ability for their age group (several had *more* exceptional SAT-Verbal scores). At Age 33, subjects were asked how much they typically work in their current job (top panel), and second, how much they would be willing to work in their ideal job (bottom panel). This figure reveals huge individual differences in time invested in vocational development. If these individual differences remain stable, which they will for at least a subset of participants, the amount of time invested in career development for some participants will be but a small fraction of what it is for others. It is reasonable to suggest that these individual differences in work hours will eventuate in a vast array of achievement outcomes, ranging from considerably below typical to extraordinary. This is an area that is crying out for more research.

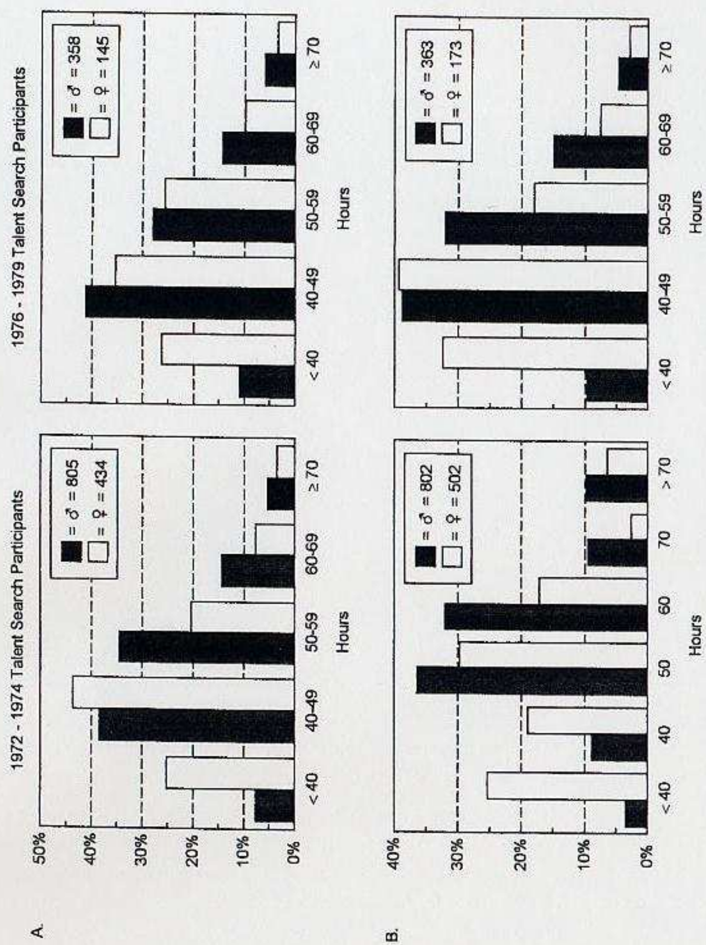

FIG. 2.6. Two questions about work taken from the Study of Mathematically Precocious Youth's 20-year follow-up questionnaire (Lubinski & Benbow, 2000). Participants were identified at Age 13 as having quantitative reasoning abilities within the top 1% of their age group. At Age 33, they were asked (a) how many hours per week they typically worked, by gender (excluding homemakers), and (b) how many hours per week they were willing to work, given their job of first choice, by gender. Note that the 1972 to 1974 participants were given six temporal options, whereas the 1976 to 1979 participants were provided with five choices.

CONCLUSION

Few endeavors are more important than helping individuals shape their lives in ways congruent with the positive features of their individuality. We have presented some concepts and empirical support for ways to facilitate socially valued achievement and personal fulfillment among intellectually talented persons. Hopefully, enough information is in this chapter to convince readers that the critical starting point is early identification. Multidimensional, above-level ability, and preference assessment can—and probably should—occur by early adolescence to adequately respond to precocious intellectual abilities with developmentally appropriate educational opportunities. This information can be invaluable for guiding talented youth toward avenues leading to rewarding and socially valued lives.

Although ability and preference dimensions are critical to assess, they should not be viewed as a panacea. We recognize that there are instabilities associated with early assessments, and that they provide only rough guide posts for facilitating educational and career planning. Indeed, periodic reassessment of these personal attributes over the course of one's development is advisable. Abilities and interests can and do change for some individuals, and assessing the magnitude of such changes is helpful for making informed educational and career choices. Yet, there is more than enough stability in these early assessments to warrant their routine use. Following Tyler (1953, 1992) and Williamson's (1965) idea that successful counseling provides clients, students, and workers with tools for taking charge of their personal development, these assessments can be especially helpful in gaining clarity when faced with conflicting counsel from family, peers, teachers, and self on how best to structure one's educational and vocational development (Lubinski & Benbow, 2001). Indeed, a cogent case could be made that failing to employ these construct-valid measures contributes to the "educational and occupational maladjustment," which years ago, D. G. Paterson (1957) called on applied psychologists to alleviate with practice based on science.

Finally, beyond the personal (endogenous) attributes important for talent development, the idea of furtherance reminds us that actualizing potential also requires several positive environmental (exogenous) conditions. Once talents and interests are identified for a given domain, "frequent, much-admired successes increase effort, build up psychosomatic vigor, make attempts more vigorous, and adequate, and better integrated, and build ability" (Pressey, 1955, p. 124). Hollingworth, Terman, Seashore, Stanley, and others have documented many examples of this process at

work. When challenging opportunities are successfully embraced and followed by additional opportunities for more sophisticated development, an environment for developing genuine excellence is provided. This is critical for the exceptional development of intellectual talent.

ACKNOWLEDGMENTS

John A. Achter, Counseling Center, Concordia College-Moorhead; David Lubinski, Department of Psychology and Human Development, Vanderbilt University.

Support for this chapter was provided by a grant from the National Science Foundation (MDR 8855625), an anonymous donor, and a Templeton Award for Positive Psychology. An earlier version of this chapter profited from comments by April Bleske-Rechek, Julian C. Stanley, and Rose Mary Webb.

REFERENCES

Achter, J. A., Benbow, C. P., & Lubinski, D. (1997). Rethinking multipotentiality among the intellectually gifted: A critical review and recommendations. *Gifted Child Quarterly, 41,* 5–15.

Achter, J. A., Lubinski, D., & Benbow, C. P. (1996). Multipotentiality among the intellectually gifted: It was never there and already it's vanishing. *Journal of Counseling Psychology, 43,* 65–76.

Achter, J. A., Lubinski, D., Benbow, C. P., & Eftekhari-Sanjani, H. (1999). Assessing vocational preferences among gifted adolescents adds incremental validity to abilities. *Journal of Educational Psychology, 91,* 777–786.

Ackerman, P. L. (1996). A theory of adult intellectual development: Process, personality, interests, and knowledge. *Intelligence, 22,* 227–257.

Ackerman, P. L., & Heggestad, E. D. (1997). Intelligence, personality, and interests: Evidence for overlapping traits. *Psychological Bulletin, 121,* 219–245.

Allport, G. W., Vernon, P. E., & Lindzey, G. (1970). *Manual: Study of Values.* Cambridge, MA: Houghton Mifflin.

Benbow, C. P. (1991). Mathematically talented children: Can acceleration meet their educational needs? In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (pp. 154–165). Boston: Allyn & Bacon.

Benbow, C. P. (1992). Academic achievement in mathematics and science between ages 13 and 23: Are there differences among students in the top one percent of mathematical ability? *Journal of Educational Psychology, 84,* 51–61.

Benbow, C. P., & Lubinski, D. (1996). *Intellectual talent: Psychometric and social issues.* Baltimore: Johns Hopkins University Press.

Benbow, C. P., & Lubinski, D. (1997). Intellectually talented children: How can we best meet their needs? In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (2nd ed., pp. 155–169). Boston: Allyn & Bacon.

Benbow, C. P., Lubinski, D., Shea, D. L., & Eftekhari-Sanjani, H. (2000). Sex differences in mathematical reasoning ability at age 13: Their status 20 years later. *Psychological Science, 11,* 474–480.

Benbow, C. P., & Stanley, J. C. (1996). Inequity in equity: How "equity" can lead to inequity for high-potential students. *Psychology, Public Policy, and Law, 2,* 249–292.

Binet, A., & Simon, T. (1905). Méthodes nouvelles pour le diagnostic du niveau intellectuel des anormaux [A method of measuring the development of the intelligence of young children]. *L'année Psychologique, 11,* 245–136.

Campbell, J. P. (1990). The role of theory in industrial and organization psychology. In M. D. Dunnette & L. M. Hough (Eds.) *Handbook of industrial/organizational psychology,* 2nd ed, Vol. 1 (pp. 39–74). Palo Alto, CA: Consulting Psychology Press.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies.* New York: Cambridge University Press.

Chorney, M. J., Chorney, K., Seese, N., Owen, M. J., McGuffin, P., Daniels, J., Thompson, L. A., Detterman, D. K., Benbow, C. P., Lubinski, D., Eley, T. C., & Plomin, R. (1998). A quantitative trait locus (QTL) associated with cognitive ability in children. *Psychological Science, 9,* 159–166.

Dawis, R. V. (1992). The individual differences tradition in counseling psychology. *Journal of Counseling Psychology, 39,* 7–9.

Dawis, R. V. (2001). Toward a psychology of values. *Journal of Counseling Psychology, 29,* 458–65.

Dawis, R. V., & Lofquist, L. H. (1976). Personality style and the dynamics of work adjustment. *Journal of Counseling Psychology, 23,* 55–9.

Dawis, R. V., & Lofquist, L. H. (1984). *A psychological theory of work adjustment.* Minneapolis: University of Minnesota Press.

Day, S. X., & Rounds, J. (1998). Universality of vocational interest structure among racial and ethnic minorities. *American Psychologist, 53,* 728–736.

Ericsson, K. A. (1996) *The road to excellence.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Eysenck, H. J. (1995). *Genius: The natural history of creativity.* Cambridge, England: Cambridge University Press.

Flanagan, J. C., & Cooley, W. W. (1966). *Project Talent one-year follow-up studies.* Pittsburgh, PA: University of Pittsburgh Press.

Galton, F. (1869). *Hereditary genius.* London: Macmillan.

Gardner, H. (1993). *Multiple intelligences: The theory in practice.* New York: HarperCollins.

Gelso, C. J., & Fretz , B. R. (1992). *Counseling psychology.* Orlando, FL: Harcourt.

Goff, M., & Ackerman, P. L. (1992). Personality-intelligence relations: Assessing typical intellectual engagement. *Journal of Educational Psychology, 84,* 537–552.

Gohm, C. L., Humphreys, L. G., & Yao, G. (1998). Underachievement among spatially gifted students. *American Educational Research Journal, 35,* 515–531.

Gottfredson, L. S. (1997). Special issue: Intelligence and social policy. *Intelligence, 24.*

Heller, K. A., Mönks, F. J., Sternberg, R. J., & Subotnik, R. F. (Eds.). (2000). *International handbook of research on giftedness and talent* (2nd ed.). New York: Elsevier.

Hobbs, N. (1951). Community recognition of the gifted. In P. Witty (Ed.), *The gifted child* (pp. 163–183). Boston: Heath.

Hobbs, N. (1958). The compleat counselor. *Personnel and Guidance Journal, 36,* 594–602.

Holahan, C. K., Sears, R. R., & Cronbach, L. J. (1995). *The gifted group in later maturity.* Stanford, CA: Stanford University Press.

Holland, J. L. (1985). *Making vocational choices* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Holland, J. L. (1996). Exploring careers with a typology: What we have learned and some new directions. *American Psychologist, 51,* 397–406.

Hollingworth, L. S. (1926). *Gifted children: Their nature and nurture.* New York: Macmillan.

Hollingworth, L. S. (1942). *Children above 180 IQ.* New York: World Book.

Humphreys, L. G., & Lubinski, D. (1996). Brief history and psychological significance of spatial-visualization abilities. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 116–140). Baltimore: Johns Hopkins University Press.

Humphreys, L. G., Lubinski, D., & Yao, G. (1993). Utility of predicting group membership and the role of spatial visualization in becoming an engineer, physical scientist, or artist. *Journal of Applied Psychology, 78,* 250–261.

Jenkins, J. J., & Paterson, D. G. (1961). *Studies in individual differences: The search for intelligence.* New York: Appleton-Century-Crofts.

Jensen, A. R. (1996). Giftedness and genius: Crucial differences. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 393–411). Baltimore: Johns Hopkins University Press.

Keating, D. P., & Stanley, J. C. (1972). Extreme measures for the exceptionally gifted in mathematics and science. *Educational Researcher, 1,* 3–7.

Kuhn, T. S. (1962). *The structure of scientific revolutions.* Chicago: University of Chicago Press.

Lofquist, L. H., & Dawis, R. V. (1991). *Essentials of person-environment-correspondence counseling.* Minneapolis: University of Minnesota Press.

Lubinski, D. (1996). Applied individual difference research and its quantitative methods. *Psychology, Public Policy, and Law, 2,* 187–203.

Lubinski, D. (2000). Assessing individual differences in human behavior: "Sinking shafts at a few critical points." *Annual Review of Psychology, 51,* 405–444.

Lubinski, D. (2001). Interests: A critical domain of psychological diversity [Review of the book *Vocational interests: Meaning, measurement, and counseling use*]. *Contemporary Psychology, 46,* 82–86.

Lubinski, D., & Benbow, C. P. (1994). The study of mathematically precocious youth: The first three decades of a planned 50-year study of intellectual talent. In R. F. Subotnik & K. D. Arnold (Eds.), *Beyond Terman: Contemporary longitudinal studies of giftedness and talent* (pp. 255–281). Norwood, NJ: Ablex.

Lubinski, D., & Benbow, C. P. (1995). Optimal development of talent: Respond educationally to individual differences in personality. *Educational Forum, 59,* 381–392.

Lubinski, D., & Benbow, C. P. (2000). States of excellence. *American Psychologist, 55,* 137–150.

Lubinski, D., & Benbow, C. P. (2001). Choosing excellence. *American Psychologist, 56,* 76–77.

Lubinski, D., Benbow, C. P., Shea, D. L., Eftekhari-Sanjani, H., & Halvorson, M. B. J. (2001). Men and woman at promise for scientific excellence: Similarity not dissimilarity. *Psychological Science, 12,* 309–317.

Lubinski, D., Benbow, C. P., & Ryan, J. (1995). Stability of vocational interests among the intellectually gifted from adolescence to adulthood: A 15-year longitudinal study. *Journal of Applied Psychology, 80,* 196–200.

Lubinski, D., & Humphreys, L. G. (1992). Some bodily and medical correlates of mathematical giftedness and commensurate levels of socioeconomic status. *Intelligence, 16,* 99–115.

Lubinski, D., & Humphreys, L. G. (1997). Incorporating general intelligence into epidemiology and the social sciences. *Intelligence, 24,* 159–201

Lubinski, D., Schmidt, D. B., & Benbow, C. P. (1996). A 20-year stability analysis of the Study of Values for intellectually gifted individuals from adolescence to adulthood. *Journal of Applied Psychology, 81,* 443–451.

Lubinski, D., Webb, R. M., Morelock, M. J., & Benbow, C. P. (2001). Top 1 in 10,000: A 10-year follow-up of the profoundly gifted. *Journal of Applied Psychology, 86,* 718–729.

Murray, C. (1998). *Income, inequality, and IQ.* Washington, DC: American Enterprise Institute.

O'Shea, M. V. (1926). Editor's introduction. In L. S. Hollingworth, *Gifted children: Their nature and nurture* (pp. xxi–xxii). New York: Macmillan.

Parsons, F. (1909). *Choosing a vocation.* Boston: Houghton Mifflin.

Paterson, D. G. (1957). Conservation of human talent. *American Psychologist, 12,* 134–144.

Plato (1945). *The republic of Plato.* (F. M. Cornford, Trans.). New York: Oxford University Press.

Plomin, R. (1999). Genetics and general cognitive ability. *Nature, 402,* C25-C29.

Prediger, D. J. (1982). Dimensions underlying Holland's hexagon: Missing links between interests and occupations? *Journal of Vocational Behavior, 20,* 259–287.

Pressey, S. L. (1946a). Acceleration: Disgrace or challenge? *Science, 104,* 215–219.

Pressey, S. L. (1946b). Time-saving in professional training. *American Psychologist, 1,* 324–329.

Pressey, S. L. (1949). *Educational acceleration: Appraisals and basic problems.* Columbus, OH: The Ohio State University.

Pressey, S. L. (1955). Concerning the nature and nurture of genius. *Scientific Monthly, 81,* 123–129.

Pressey, S. L. (1967). "Fordling" accelerates ten years after. *Journal of Counseling Psychology, 14,* 73–80.

Roe, A. (1956). *The psychology of occupations.* New York: Wiley.

Rounds, J. B., & Tracey, T. J. (1990). From trait-and-factor to person-environment fit counseling: Theory and process. In W. B. Walsh & S. H. Osipow (Eds.), *Career counseling: Contemporary topics in vocational psychology* (pp. 1–44). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Savickas, M. L., & Spokane, A. R. (1999). *Vocational interests: Meaning, measurement, and counseling use.* Palo Alto, CA: Counseling Psychologists Press.

Schmidt, D. B., Lubinski, D., & Benbow, C. P. (1998) Validity of assessing educational-vocational preference dimensions among intellectually talented 13-year-olds. *Journal of Counseling Psychology, 45,* 436–453.

Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124,* 262–274.

Seashore, C. E. (1922). The gifted student and research. *Science, 56,* 641–648.

Seashore, C. E. (1930). Carl Emil Seashore. In C. Murchison (Ed.), *A history of psychology in autobiography* (Vol. 1, pp. 225–297). Worcester, MA: Clark University Press.

Seashore, C. E. (1942). *Pioneering in psychology.* (University of Iowa Studies, No. 398). Iowa City: University of Iowa Press.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55,* 5–14.

Shea, D. L., Lubinski, D., & Benbow, C. P. (2001). Importance of assessing spatial ability in intellectually talented young adolescents: A 20-year longitudinal study. *Journal of Educational Psychology, 93,* 604–614.

Simonton, D. K. (1988). *Scientific genius.* Cambridge, U.K.: Cambridge University Press.

Simonton, D. K. (1999). Talent and its development: An emergenic and epigenetic model. *Psychological Review, 106,* 435–457.

Stanley, J. C. (1954). Identification of superior learners in grades ten through fourteen. *Supplemental Educational Monographs, No. 81* (pp. 31–34). Chicago: University of Chicago Press.

Stanley, J. C. (1973). Accelerating the educational progress of intellectually gifted youth. *Educational Psychologist, 10,* 133–146.

Stanley, J. C. (1974). Intellectual precocity. In J. C. Stanley, D. P. Keating, & L. H. Fox (Eds.), *Mathematical talent: Discovery, description, and development* (pp. 1–22). Baltimore: Johns Hopkins University Press.

Stanley, J. C. (1977). Rationale of the Study of Mathematically Precocious Youth (SMPY) during its first five years of promoting educational acceleration. In J. C. Stanley, W. C. George, & C. H. Salano (Eds.), *The gifted and the creative: A fifty year perspective* (pp. 73–112). Baltimore: Johns Hopkins University Press.

Stanley, J. C. (1990). Leta Hollingworth's contributions to above-level testing of the gifted. *Roeper Review, 12,* 166–171.
Stanley, J. C. (1996). SMPY in the beginning. In C. P. Benbow & D. Lubinski (Eds.), *Intellectual talent: Psychometric and social issues* (pp. 225–235). Baltimore: Johns Hopkins University Press.
Stanley, J. C. (2000). Helping students learn only what they don't already know. *Psychology, Public Policy, and Law, 6,* 216–222.
Strong, E. K. (1943). *Vocational interests of men and women.* Palo Alto, CA: Stanford University Press.
Super, D. E. (1949). *Appraising vocational fitness.* New York: Harper.
Terman, L. M. (1954). The discovery and encouragement of exceptional talent. *American Psychologist, 9,* 221–230.
Terman, L. M., & Oden, M. H. (1947). *Genetic studies of genius: Vol. 4. The gifted child grows up.* Stanford, CA: Stanford University Press.
Terman, L. M., & Oden, M. H. (1959). *Genetic studies of genius: Vol. 5. The gifted group at mid-life.* Stanford, CA: Stanford University Press.
Tyler, L. E. (1953). *The work of the counselor.* New York: Appleton-Century-Crofts.
Tyler, L. E. (1965). *The psychology of individual differences* (3rd ed.). New York: Meredith.
Tyler, L. E. (1974). *Individual differences: Abilities and motivational directions.* New York: Meredith.
Tyler, L. E. (1992). Counseling psychology: Why? *Professional Psychology: Research and Practice, 23,* 342–344.
U.S. Department of Education, National Center for Education Statistics. (1997). *Digest of Education Statistics, 1997* (NCES 98–015). Washington, DC: Author.
Viteles, M. S. (1932). *Industrial psychology.* New York: Norton.
Webb, R. M., Lubinski, D., & Benbow, C. P. (2002). Mathematically facile adolescents with math/science aspirations: New perspectives on their educational and vocational development. *Journal of Educational Psychology, 94,* 785–794.
Williamson, E. G. (1939). *How to counsel students.* New York: McGraw-Hill.
Williamson, E. G. (1965). *Vocational counseling: Some historical, philosophical, and theoretical perspectives.* New York: McGraw-Hill.
Witty, P. (Ed.). (1951). *The gifted child.* Boston: Heath.