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The Elusive Search for the Gifted Personality

Mimi Wellisch¹ and Marion Porath²

Guest Editorial

Gifted literature is nothing if not replete with descriptions of the abilities and antics of geniuses, the jaw-dropping abilities of savants, and the differentness of precocious children in comparison with their developmentally average age-peers. The gifted field has given rise to a multitude of gifted characteristics, specific terminologies, definitions, and models of giftedness and educational strategies. Millions of words and pages filled with anecdotes and descriptions of gifted children and adults attest to our fascination with the phenomenon. Our intense interest has created in us a ‘rage to master’ the subject of giftedness (Winner, 1996) – a need to know how it arises, develops, how it leads to eminence and why it may not lead anywhere at all. This has fuelled our quest to find its essence, the core characteristics that would help define and identify giftedness. Our passionate treasure hunt, the elusive search for the gifted personality, is the subject of this special issue, an issue inspired by a keynote address, Passion for learning: The experience of being consumed by learning, given by Laurence Coleman at the 11th Asia Pacific Conference on Giftedness, Sydney, Australia, 2010. Through its portraits of children with exceptional gifts in domains outside those typically considered by schools, the address captured the complexity of giftedness and the many questions that arise about what giftedness “is” and how it can be nurtured.

We begin with Porath’s thoughtful article, provoking us to consider just what we may be searching for when we talk of the “gifted personality.” Studies on giftedness and personality are not very helpful as findings across studies are confounded by variation in definitions of both constructs and fail to take into account the contextual variables in exceptional achievement. Potential characteristics of a ‘gifted personality’ may be intense love of learning and powerful intuitions about the fields of endeavour to which gifted individuals are drawn. Porath argues that such characteristics must be studied in a systemic way, taking into account the complexity of both giftedness and personality, the contexts that support excellence, the developmental trajectories of giftedness and personality, and collaborative aspects of innovation and giftedness. The article concludes with questions to inform a new research agenda.

From Porath’s big picture view we move to traits of gifted groups and individuals. Shani-Zinovich and Zeidner’s review of Israeli research findings introduces the reader to the Israeli education system’s approach to identification and education of gifted students. The system consists of a screening and an identification phase followed by special educational programs. The authors discuss how inconsistencies in the literature aimed at discerning personality differences between gifted and non-gifted individuals may involve the ways the gifted are defined, small and non-representative samples, the use of clinical measures or personality assessments not satisfactorily validated by empirical research, and the use of norm group data for comparisons. The article then moves to empirical Israeli research related to the personality and affective characteristics of gifted students. The authors discuss group differences along both broad personality factors and personal traits. They cite findings using the Five-Factor Model for gifted students indicating they are lower on Neuroticism (N) and higher on Openness to Experience (O) than their non-gifted counterparts. Shani-Zinovich and Zeidner examine research on the mental health and emotional competencies of gifted students, concluding the article with a number of broad observations on Israeli research conducted over the past few decades.

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Ngara’s fascinating article outlines two of his qualitative studies and their findings, taking us from a Western view on gifted Israeli children’s characteristics to an African perspective. The first study involves 16 Zimbabwean academics of Shona cultural background and their views on giftedness and talent, and we learn that giftedness traditionally involves a gift from God, a spirit for a particular pursuit (e.g., a spirit for academic achievement). Shona is one of the most historically distinctive and widely dispersed languages in Central-Southern Africa, involving at least 14 countries. The Shona view of giftedness therefore has wider comparability and applicability within the Sub-Saharan Africa region. The second study involves the views of 20 Shona stone sculptors, specifically in the way they conceptualize the origins and development of vision and inspiration for their art. Ngara’s article includes his Dynamic and Interactive Process Model (DIPM), an outcome of his findings, and a discussion on possible applications of the model in educational contexts.

Next we return to the Western conception and measurement of giftedness that, argues Merrotsy, add to the issues and contexts that give rise to the invisibility of some gifted children due to cultural and socio-economic factors. Merrotsy argues that these children’s school performance and measured intelligence are significantly below their high learning potential. He describes these children as struggling with self-identity, low self-efficacy, a fear of failure, and as lacking trust in the education system and in their teachers. The article presents examples from five projects that focus on identification of ‘invisible’ gifted children using a model of dynamic assessment. Subsequent interventions based on these assessments have resulted in academic and social-emotional gains. Merrotsy concludes that variation in personality types within the ‘gifted population’ equals the variation across the whole population, making the quest to identify the gifted personality difficult, with the invisible gifted being the most elusive of all.

The special issue closes with Wellisch and Brown’s article which first traces some of the efforts made to identify gifted types and characteristics. The characteristics of the overexitabilities (OEs) from Dabrowski’s (1972) Theory of Positive Disintegration (TPD) are included in the discussion as they are frequently applied in the literature to gifted behaviours and problems. Wellisch and Brown then review the literature on maternal depression and attachment difficulties early in life and cite their own research on associations between giftedness, attachment and maternal depression. They propose that early trauma may impact on gifted development, and that traumatic events rather than overexcitabilities, may shape the observable characteristics of gifted children. Wellisch and Brown point out the difficulty in identifying giftedness in children who may have associated disorders, and suggest that the elusive gifted personality may be found instead within a spectrum of giftedness. The article concludes with The Spectrum of Gifted Characteristics, a screening table of gifted characteristics in children without disorders, as well as projections of specific characteristics in gifted children with DSM-5 disorders such as ADHD and Specific Learning Disorders.

The search for a “gifted personality” will remain elusive unless we reframe our thinking fundamentally, starting with a critical analysis of our conceptions of giftedness and what it means to achieve excellence in the 21st century. We also need to acknowledge the complexity of giftedness in our thinking and research by considering personal, social, and cultural variables that may influence the realization and expression of giftedness. The articles in this special issue offer different perspectives on how we may recognize, honour and support potential.
The Guest-Editors

Mimi Wellisch is a registered psychologist who is passionate about providing opportunities for gifted children. She also has a Master of Early Childhood from Macquarie University, where she is completing a PhD thesis on the connection between attachment and IQ. Mimi is the author of a number of books and peer reviewed and other articles, and has presented papers and workshops at many local and international conferences. She has also held the positions of President, Vice President, and Treasurer of the NSW Association for Gifted and Talented Children.

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The Gifted Personality: What Are We Searching For and Why?

Marion Porath*

Abstract: Literature on the personality traits of individuals considered gifted is equivocal, influenced by variation in definitions of both constructs and a focus on individuals that fails to take account of contextual variables in exceptional achievement. Potential characteristics of a “gifted personality” may be intense love of learning and powerful intuitions about the fields of endeavour to which gifted individuals are drawn. These characteristics must, however, be studied in a systemic way, taking into account collaborative aspects of innovation and giftedness. A research agenda is suggested, informed by questions that involve rethinking the individualistic approach to studying personality and giftedness, considering the nature of contexts that facilitate noticing and supporting giftedness, and studying the developmental course of a gifted personality. The questions we ask and the methods we use should also be informed by current thinking about collaborative work that leads to outstanding accomplishments.

Keywords: giftedness, personality, innovation, development, education

The definitions of gifted are many and varied, differing across scholarly writings (e.g., Sternberg & Davidson, 2005), culture (e.g., Phillipson & McCann, 2007), history (Gould, 1981), and educational jurisdictions (Foster, Porath, & Smyth, 2009). It is unlikely that consensus on a definition will be achieved given measurement issues (Keating, 1991), the dynamic nature of giftedness (Jackson, 2000), and the “mysterious” nature of giftedness as defined by high IQ (Matthews & Foster, 2009). Still, every culture holds excellence in certain domains in high esteem and nurtures those who demonstrate outstanding capability to become eminent thinkers, writers, artists, navigators, storytellers, hunters, or musicians who contribute significantly to their culture (Gardner, 1983; Phillipson & McCann, 2007). This outstanding capability is often noticed in early childhood, accompanied by personality traits like intense drive, high energy, and confidence (Gottfried, Gottfried, Bathurst, & Guerin, 1994; Janos & Robinson, 1985; Winner, 1996). However, the literature is equivocal as to the relationship of personality and giftedness. This paper examines extant literature, offers directions for research, and suggests ways of thinking about personality that may offer potential for understanding and nurturing individuals whose abilities and motivation to achieve are exceptional.

What is Personality?

“Personality” comes from personalitas (Latin, 5th century), one’s personal nature. Originally one’s personal nature or character was conceived of theologically, reflecting the Christian Trinity. This Christian interpretation continued in the Anglo-Norman personalité (13th century) and eventually evolved in the late 17th century to more secular meanings in a variety of languages that referred to a person’s character, nature, quality, or traits, meanings that are still relevant today (Oxford English Dictionary, 2012). The study of personality became a focus of psychological and sociological research in the 20th century with efforts to define and measure the factors that constitute personality (e.g., among others, extraversion, independence, self-control, Cattell & Cattell, 1995; conscientiousness

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and agreeableness, Costa & McCrae, 1992). There is a small body of literature focused on personality traits demonstrated by individuals identified as gifted. These studies attempt to add to knowledge of what defines giftedness and the personal attributes that contribute to the achievement of excellence.

**Intellectual Giftedness and Personality**

Notions of personality differed in studies retrieved through a database search of “personality and giftedness.” While some included traits that correspond to those included in the Sixteen Personality Factor Questionnaire (16 PF; Cattell & Cattell, 1995), for example, Shaughnessy et al. (2004) and the “Big Five” personality traits of openness, conscientiousness, extraversion, agreeableness, and neuroticism (Costa & McCrae, 1992), for example, Zeidner and Shani-Zinovich (2011), others considered Dabrowskian levels of emotional development and “overexcitabilities” (Carman, 2011; Miller & Silverman, 1987), and “psychodynamic” profiles informed by Freudian and developmental theories (Adamson, 1982).

Efforts to relate giftedness to the well-established 16 PF traits were mixed. Persistence, independence, and conscientiousness were found to be exhibited by gifted individuals and to be related to the realization of giftedness (Franks & Dolan, 1982). Shaughnessy et al. (2004) compared mean scores of students identified as gifted in different countries to theoretical means on the 16 personality factors. No scores were more than slightly above average, making their claim that emotional stability, social boldness, and private nature are relevant considerations in education of gifted students a tenuous one. The lack of clear differences between gifted students and theoretical means may be due to the lack of precision in defining samples of gifted students across the countries included, although comparisons to theoretical means are also problematic (Zeidner & Shani-Zinovich, 2011).

Zeidner and Shani-Zinovich (2011) used the Five-Factor Model (Costa & McCrae, 1992) to compare the traits of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness in gifted and non-gifted Israeli high school students. Personality profiles of the two groups were not parallel, with gifted students scoring significantly higher on the openness to experience factor and significantly lower on the neuroticism and agreeableness factors.

While these findings are interesting and consistent with other research, as Zeidner and Shani-Zinovich (2011) pointed out, group differences cannot address the complexity involved in personality development. They also acknowledged that the study did not take into account the potential relevance of both direct and interaction effects of cultural and educational contexts.

Literature on personality and giftedness is equivocal. Definitions and measurement of relevant constructs vary, and development is not considered as a potentially relevant variable (Gockenbach, 1989; Janos & Robinson, 1985). Studies also suffer other methodological weaknesses, including small samples, non-representative samples, psychometrically inadequate measures, and comparison to norms rather than an appropriate comparison group (Zeidner & Shani-Zinovich, 2011). Janos and Robinson (1985) described the literature as “disorganized” (p. 167) and confined their review to relatively consistent studies of characteristics that bore “directly upon the development of intellectual talent” (pp. 167–168), namely breadth of mature interests and depth in some of those interests; hard work and perseverance; high standards; ability to delay gratification; and “the self-sufficiency necessary to pursue goals they find important, even if their choices are not always validated by parents or friends” (p. 168). However, Janos and Robinson advised caution in generalization, pointing out that individuals not identified as gifted also demonstrate high achievement and others come to be identified as gifted later in life because of their personality characteristics. Studies of personality as it relates to giftedness don't take us very far in searching for a “gifted personality.” However, personality and motivational factors are believed to be more important than ability in the
achievement of excellence (Winner, 1996; cf. Goleman’s (1995) discussion of social-emotional variables that are more important than IQ in predicting success). Perhaps we need to broaden our search.

**Personal Factors Associated with Giftedness**

Winner (1996) described the “rage to master” demonstrated by gifted children. This intense intrinsic motivation involves the capacity for focus, the experience of “flow” when optimally involved in learning, independence, and other characteristics similar to those Janos and Robinson (1985) deemed directly related to the development of intellectual talent. The passion and drive described by Winner (1996) are typically associated with subsequent adult creativity. However, Winner was careful to point out, “Many factors are involved, factors interacting in ways we do not fully understand” (p. 282). Furthermore, these interactions take place across the life span; we have few studies that take a life span perspective to help us understand different developmental pathways to adult accomplishment.

There is convergent evidence that supports the suggestion of an association of intense love of learning with giftedness and great accomplishment, however. Coleman (2010) studied children who demonstrated passion for learning. Each conveyed a love for, and unusually advanced mastery of, their area of interest. Gross (1998), in her portrayal of the intensity that characterizes exceptionally gifted children and adolescents, quoted Dante – “the mind in love” (p. 174) – to describe their passionate love of learning. Gifted children who participated in a study focused on their identities as learners (Porath & Lupart, 2009) showed their love of learning in their responses to what learning in general meant to them and what reading meant to them.

Learning is like a wave of knowledge coming into my head and it just feels good.

Reading means a lot to me cause I love reading. I love reading a lot…. I just get stuck into the book. I can’t think of anything else. I just get stuck into the book.

[Reading is] an escape. It’s something that I love to do, something that I will do at any cost. It’s an exploration, and it’s a way to learn what I love, expand my vocabulary, expand my concepts and challenge the way I think. I will read articles by people who have completely different political viewpoints from mine, to see if I can play the devil’s advocate. To me, in fact, this is what I like to do.

(Porath, 2004)

Shavinina and Seeratan (2004), using the term, “extracognitive phenomena,” discussed something similar to the passionate involvement in learning described above in their study of Nobel laureates and other exceptionally accomplished individuals. Autobiographical and biographical findings revealed the role of “specific feelings, preferences, and beliefs, and other similar phenomena” (p. 73) in their expertise and accomplishments. Shavinina and Seeratan cited Einstein, Hadamard, and Poincaré who emphasized “feeling of direction,” “feeling of mathematical beauty,” and “intuitive flair” (pp. 73–74), respectively, as central to their work. Several Nobel laureates described the beauty and harmony in their work, their feeling for what was right and elegant, and their sense of important problems. Shavinina and Ferrari (2004) considered the extracognitive phenomena just described as aspects of personality traits associated with giftedness. This new research direction is thought to be “an innovative way to address the topic of high ability, within which many insights in the psychology of giftedness, creativity, genius, and wisdom may be hidden (Shavinina & Ferrari, 2004, p. 8). This research direction, in combination with interrogation of the thinking and models of giftedness that underpinned previous studies of personality and giftedness, may be critical in helping us move forward. Moving forward in this way may facilitate our understanding of the elusive “something” in persons that is important in the complex interactions that result in outstanding achievement.
Rethinking Personality and Giftedness

Three questions are relevant to making meaningful the search for the “gifted personality” – the question of “who” is the focus of the search and the question of “how” we understand, support, and perhaps “create” (Hymer, 2009) persons who demonstrate excellence. The question of “when” also is important, given the identified need for longitudinal research on personality and giftedness (Janos & Robinson, 1985) and the complexity of developmental timing (Rose, Daley, & Rose, 2011). In the following subsections, these three questions are taken up with a view to providing the context for research and educational directions that deserve our consideration. The questions may provide a way of moving beyond “narrative fallacies” (Kahneman, 2011, p. 199) or explanatory stories that “provide simple and coherent account[s] of people’s actions and intentions” (Kahneman, 2011, p. 199), following the human tendency to avoid complexity and interpret behaviour in terms of general impressions and personality traits. We need to move beyond what Kahneman described as the “powerful WYSIATI rule” (p. 201; what you see is all there is) to consideration of complex models of understanding personality and giftedness.

Rethinking “Who”

The field of gifted education is moving rapidly away from questions involving who gifted individuals are, a question that focuses on identification and sorting people into categories (Dweck, 2009). This focus on persons (Ziegler, 2005) has been replaced by the more complex questions of the types of interactions and contexts that shape giftedness, that consider the contexts in which persons develop. Who questions have proven particularly difficult to answer historically…. The difficulty lies not in the fact of human variability… but in the challenge that comes with trying to characterize that variability, delineating its origins, and determining what (if anything) it means in the context of education. (Rose et al., 2011, p. 154)

Who questions have their roots in the differential psychology of the late 19th and early 20th century, where a dimensional model of human variability (Rose et al., 2011) underpinned thinking about how individuals differ from each other. However, differences are also apparent within individuals as they interact with different people, in different environments, doing different tasks, with different levels of support (Fischer & Bidell, 2006; Rose et al., 2011). Is personality stable across these different contexts? A trait theory, focused on persons, would answer in the affirmative.

The trait approach to studying giftedness – and personality – is, however, not viewed as a productive way forward to understanding excellent performance in any field or to the survival of research on giftedness (Ziegler, 2009). It fails to capture the complexity and richness of human experience, particularly in ways that may offer insights into how mind, brain, and education interact – how unique cognitive experiences, biology, and educational contexts and strategies may work in concert to lead to optimal developmental outcomes (Rose et al., 2011; Ziegler, 2009).

Rethinking “How”

Giftedness is only one of the many factors – for example, motivation, effort, mentorship, and supportive home and school environments – that lead to academic and career success (Ziegler 2005). As Ziegler went on to argue, our goal “is not to categorize persons as gifted, but rather to identify a learning path for an individual that leads to excellence” (p. 431). Personality may be a consideration in planning a learning path, taking into account questions like, “What teaching approaches are the best match for this highly motivated student?” “Who would be an appropriate mentor?” “In what contexts does this student demonstrate passion for learning?” “In what contexts does he or she appear unmotivated?” “How can this student’s potential be realized?”

The above are critical sub-questions to address Dweck’s (2009) overarching question, “What could matter more than understanding how people can fulfill their extraordinary
potential?" They reflect the contemporary emphasis on “smart contexts” rather than “smart people” (Barab & Plucker, 2002). When our efforts are directed to designing rich educational environments, the possibilities for fulfilling, and discovering, potential are optimized (Barab & Plucker, 2002; Hymer, 2009). Jackson (2000) argued that our energies are much more productively directed to putting complexity into environments than continuing to attempt to define the complexity of giftedness.

Can we develop a “gifted personality”? Might personality be more “state” than “trait”? Might it vary according to the context in which an individual finds him/herself and the degree and nature of support available in that context? Passion for learning can be encouraged, supported, and sustained by responding to students’ interests, modeling curiosity and love of learning, provoking creative thinking, and providing rich educational environments (Bransford, Brown, & Cocking, 2000; Duckworth, 1987; Egan, 2010; Rinaldi, 2001; Rodari, 1973). Tacit knowledge underpins the intuitions of outstanding thinkers and teachers and is “crucial to active performance in a field” (Ferrari, 2004, p. 217). The features of tacit knowledge have direct relevance to education: it is “procedural; ... relevant to valued goals; and ... acquired through practical experience (often with mentoring), and not through logical analysis presented in texts or in class” (Ferrari, 2004, p. 217).

Deciding “When”

Janos and Robinson (1985) noted, “The apparent coherence in the personality structure of intellectually gifted children is ... based on a collection of basically nondevelopmental findings” (p. 168). Cross-sectional and longitudinal studies are essential to answer the questions of what develops, what changes, and what may need to be done educationally to accommodate change and development. Jackson (2000) noted the dynamic nature of giftedness and how concomitant educational needs change over time. The same may be true of what motivates learning, supports perseverance, encourages sensitivity, and develops insight. The question of “when” is also complex and may, like the questions of “who” and “how,” require an interdisciplinary approach to further our knowledge (Rose et al., 2011).

The “Contemporary Gifted Personality”?

Ziegler (2009) looked to research on innovation to inform contemporary research on giftedness. The two fields of study have overlapping interests but Ziegler saw innovation research as offering ways of changing the paradigm for research on giftedness. Ziegler offered his own innovative take on how we might conceptualize a research agenda in the 21st century – the “tower of creativity.” This tower has implications for how we examine the relationship between personality and giftedness.

The tower has six floors. Floors 3 to 6 are most relevant to this discussion (see Ziegler, 2009, pp. 1516–1522 for a complete discussion of the tower of creativity, including the names assigned to each set of creatures). Popperian creatures inhabit Floor 3. They can create and manipulate models of the world and survive via their intelligence and creativity. On Floor 4 live the Spencerian creatures, creatures who benefit from belonging to adaptive social groups. The emphasis on this floor is on capitalizing on the knowledge available and working collectively toward innovative achievements. Gregorian creatures on Floor 5 have the advantage of adding sophisticated tools to individual thinking and collective achievements. They capitalize on what the environment has to offer. On the top floor, Floor 6, are the Blue Brain creatures. They “exist in the form of cognitive networks, teams that utilize tools” (Ziegler, 2009, p. 1521).

Research centers, which educate their own scientific offspring with specific talents and specifically develop research instruments to insure the evolution of the field itself, are perfect examples of Blue Brain creatures…. A defining characteristic is that they have, as a solid goal, the evolution of themselves and their tools in order to attain their creative
objectives. (Ziegler, 2009, p. 1521)
This vision of contemporary giftedness is akin to Dweck's (2009) vision of developing and sustaining talent, as opposed to “identifying and describing the gifted few” (p. xiii), as the way forward. Dweck notes the multidisciplinary, multifaceted, and collaborative nature of this endeavour. Moreover, the questions we ask as we undertake this collaborative venture are important in moving the study of giftedness and personality forward (cf. Rose et al., 2011).

Some provocative questions conclude the paper. Is there a personality best matched to contributing to networks, designing and utilizing tools, and creating new knowledge? Or should we be thinking of how different personalities interact in optimal ways in a “Blue Brain” environment? That is, perhaps the personalities and innovative qualities of teams should be our priority? Are individual personal qualities important in this mix? What social and cultural beliefs and norms should be taken into account? What are the appropriate research methods to address questions such as these? Complexity in research and education is necessary to match the complex development of personal qualities and gifts.

References


Hymer, B. J. (2009). Beyond compare? Thoughts towards an inclusional, fluid and non-


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The Elusive Search for the Personality of the Intellectually Gifted Student: Some Cross-Cultural Findings and Conclusions from the Israeli Educational Context

Inbal Shani-Zinovich and Moshe Zeidner

Abstract: The non-cognitive characteristics of intellectually gifted children have traditionally been given short shrift when compared to the extensive research on the cognitive facets of gifted children and instructional issues in teaching gifted children and youth. Our working assumption is that a systematic understanding and mapping out of the personality and affective profile of intellectually gifted students is essential for a comprehensive understanding of the factors affecting gifted students’ well-being and personal thriving, as well as for the maximal utilization of the high cognitive potential of intellectually gifted students. This paper reviews empirical research related to the personality and affective characteristics of gifted students, showcasing cross-cultural research originating in the Israeli educational context. We discuss group differences along both broad personality factors as well as more narrow-band personal traits. We also examine research focusing on mental health and emotional competencies of gifted students. We conclude with a number of broad observations garnered from the Israeli research conducted over the past few decades.

Keywords: gifted students, personality, affect, self-concept, anxiety, mental health

The literature examining the personality and affective characteristics and development of intellectually gifted children and youth has a long and chequered history. The literature is permeated by a heated debate between the advocates of two polar positions (Richards, Encel, & Shute, 2003). On one hand, on account of their rich intellectual capabilities, gifted students are claimed to show normative (or even superior) psychosocial adjustment relative to their non-gifted counterparts. Accordingly, a high level of intelligence may be construed as a “resource” or “resistance factor” which helps gifted adolescents cope with the stresses, challenges and life tasks throughout the different stages of their emotional and social development (Bracken & Brown, 2006; Richards, Encel, & Shute, 2003). On the other hand, it is claimed that intellectually gifted children and youth are particularly vulnerable and at risk for the development of social and emotional problems during critical times of their development (Masse & Gagne, 2002; Robinson, 1996; Robinson, Reis, Neihart, & Moon, 2002). Many of these difficulties are attributed to their unique personal and developmental characteristics such as asynchronous development, that is, the marked disparity between the intellectually gifted adolescent’s accelerated cognitive development, on one hand, and affective or socio-emotional development, on the other; negative labelling and stereotyping of gifted students (“nerds,” “geeks,” “bookworms,” “eggheads”); isolation from normative peer groups; unrealistic parental performance expectations; and heavy social pressure to excel in school (Neihart, Reis, Robinson, & Moon, 2002). Moreover, a growing body of recent research supports the notion that intellectually gifted youth are frequently at risk for the development of social and emotional complications during critical periods of their development, particularly during their adolescent years (e.g., Masse & Gagne, 2002; Plucker & Stocking, 2001).

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This paper sets out to review empirical research related to the personality and affective characteristics of gifted students, showcasing the research of our team in the Israeli educational context. The non-cognitive characteristics of gifted children both in Israel and across the globe have traditionally been given short shrift when compared to the body of research bearing on the cognitive facets of intellectually gifted students along with instructional and pedagogical issues in teaching gifted children and youth. Our working assumption is that a systematic understanding and mapping out of the personality and affective profile of gifted students is essential for a comprehensive understanding of the factors affecting the intellectually gifted student's well-being and personal thriving, as well as for the maximal utilization of the high cognitive potential of intellectually gifted students.

We begin by presenting a general social and educational backdrop for understanding research on giftedness in Israel. This is followed by an account of the broad personality factors in gifted students, in comparison to their non-gifted counterparts, using the Five-Factor Model (FFM) as our major theoretical framework. We move on to discuss two narrow-band personal variables, that is, self-concept, and anxiety, that are highly relevant to the affective development of gifted students. We then look at research focused on mental health and life success of gifted students. We conclude with a number of broad observations garnered from the research conducted over the past few decades in Israel.

**Gifted Education in Israel**

The Israeli national educational system has long been committed to providing appropriate resources for students with special needs, including the intellectually gifted student. The Division for Gifted and Talented Students of the Israeli Ministry of Education has provided these services. Two major goals have guided gifted education policy in Israel: (a) To develop and evaluate educational programs and interventions congenial to the special needs of students, and (b) To identify and utilize the human potential and special talent that giftedness implies for the future development of human capital and resources in Israeli society (The Ministry of Education in Israel, 2011; see also Peyser, 2005; Shani-Zinovich, 2009).

According to the current policy of the Israeli Ministry of Education, special educational programs are offered to individuals who are identified as scholastically gifted, based on overall scholastic achievements and cognitive ability test performance. Each year, the educational system employs a two-stage process for the identification of gifted students in the Israeli school system, in grades 2 to 3. The first stage involves an initial screening procedure, in which all students in grades 2 or 3 are tested. This stage involves the administration of standardized group-administered achievement tests which are designed to gauge the student's academic level in two key areas: reading comprehension and arithmetic. National cut-off scores, based on the top 15% of the students in a particular year nationwide, are employed in order to identify those students eligible for the next stage of selection. In the second stage, the identification phase, an advanced placement test is group-administered for the purpose of selecting gifted children for special programs. Each test battery is comprised of several sub-tests containing verbal, numerical, and figural tasks that are commonly used in intelligence tests. One to three percent of the students taking this test, and obtaining the highest scores in their respective school districts, are recommended for special enrichment programs.

In contrast to traditional psychometric practice, in which test scores are interpreted according to national age norms, the test scores for identification of gifted students are interpreted according to specific regional norms. The use of local norms is designed to reduce bias against children coming from low socioeconomic backgrounds (Peyser, 2005).

Two major programs are offered to gifted school children in the Israeli school system: (1) **Special homogeneous classes for intellectually gifted students.** Children
attending this program study in a special class with other gifted students in a regular municipal school. Teaching involves an acceleration of the standard curriculum. Gifted classes are offered in a limited number of large cities in elementary schools (3rd or 4th grade onwards), junior-high and high schools (up the 12th grade). Although the standard curriculum is taught, teachers in these classes tend to emphasize co-operative learning, work in small groups, and individually paced student work. In addition, these classes generally provide the opportunity for individual students to select and pursue their own areas of interest and enrichment experiences, such as individual research projects and field trips.

(2) Mixed ability classes, with pull-out programs. These programs usually serve students from a broad catchment area and are employed in most cases in grades 4 through 9. Children who attend these programs attend mainstream classes at their regular school, but attend a special program one day each week in a regional center. The enrichment classes are held in a relatively non-evaluative and relaxed learning environment outside school grounds; the contents are of an enrichment nature, and no grades are given for participating in this program.

In the sections to follow we examine research focusing on the personality and socio-emotional profiles of gifted vs. non-gifted students. Additionally, the effects of contextual factors on personality variables will be presented.

Personality

Although many different personality traits have been linked to individual differences in intelligence and giftedness, research on personality is increasingly structured around the Five-Factor Model (FFM), which provides a comprehensive theoretical framework for the systematic assessment of traits (McCrae et al., 2002). The FFM consists of the following five broad personality factors (Big-Five): Neuroticism (N), Extraversion (E), Openness to Experience (O), Agreeableness (A), and Conscientiousness (C), and each is defined by a number of more specific traits or facets.

In one of the few studies comparing gifted and non-gifted adolescents on the Big-Five, McCrae et al. (2002) reported that American high school students were about half a standard deviation lower in N and about half a standard deviation higher in O than their non-gifted counterparts. The existing literature is inconsistent with respect to the relationship between intelligence and the remaining factors of the FFM.

Unfortunately, the literature aimed at discerning personality differences between gifted and non-gifted individuals is plagued by a number of serious methodological pitfalls and shortcomings (Martin, Burn, & Schonlau, 2010). These include: inconsistencies in defining gifted individuals; employment of small and non-representative samples; use of clinical measures or personality assessments not satisfactorily validated by empirical research (e.g., MMPI, CPI); and use of norm group data for comparisons, rather than conducting concurrent comparisons between gifted students and their non-gifted same-aged peers. Taken together, the constraints of current research limit the tenability of reported findings and generalizations about personality differences between gifted and non-gifted students.

In order to improve upon the shortcomings of prior research, Zeidner and Shani-Zinovich (2011) recently examined a representative sample of academically gifted (N = 374) and non-gifted (N = 428) Israeli high-school students enrolled in grades 10 to 12 in order to compare these two student populations on the “Big-Five.” Gifted students in Israel reported higher mean O scores compared to their same-age non-gifted peers, by the order of half a sigma unit. These findings are consistent with prior research suggesting that O is the Big-Five personality factor most closely associated with intelligence (Zeidner & Matthews, 2000) and consistent with data presented by McCrae et al. (2002) for adolescents in the U.S. Indeed, gifted individuals are characterized by a number of traits typically associated with O, such as perceived intellect, curiosity, originality, imagination,
creativity, and a wide range of intellectual, artistic, and aesthetic interests (Kaufman, 2009). In addition, gifted Israeli students demonstrated lower mean levels of N compared to their non-gifted counterparts, by the order of a quarter sigma unit. These data are consistent with prior research indicating that N is negatively related to psychometric intelligence (Ackerman & Heggestad, 1997). Individuals who are high on N (i.e., low on emotional stability) may tend to focus on their tense emotional state and experience self-related cognitions that frequently interfere with their cognitive performance (Zeidner, 1998).

Prior research has shown A to be negligibly and inconsistently related to intelligence; however Israeli gifted students surprisingly scored lower on A compared to non-gifted students. It is not implausible that some of the temperamentally based primary facets of A, that is, trust, straightforwardness, altruism, warmth, compliance, modesty, and tender-mindedness, are lower in gifted students due to their competitive and perfectionist strivings. In fact, some evidence from occupational studies suggest that low A individuals may have more competitive drive than their more agreeable counterparts (Boudreau, Boswell, & Judge, 2001). Our data did not reveal significant differences between gifted and non-gifted students on the remaining factors of the Big Five, that is, E and C (Zeidner & Shani-Zinovich, 2011). Next, we briefly examine two narrow-band personal-developmental variables that is, self-concept and anxiety in gifted adolescents.

**Self-Concept**

Self-concept is viewed as a dynamic multidimensional construct (Byrne, 1988), referring to the total amount of self-related information that the person processes, stores, and organizes systematically. Studies focusing on the self-concept of gifted children and youth reveal mixed findings. A modicum of studies support the notion that gifted children have relatively higher self-concepts than non-gifted students (Hoge & Renzulli, 1993; McCoach & Siegel, 2003). Other studies, however, support the opposite conclusion, noting that the development of self-concept in gifted children may be qualitatively different from that of non-gifted children (Shi, Li, & Zhang, 2008).

Research comparing gifted and non-gifted students on various facets of self-concept, aside from academic and social facets, is scant. In order to test group differences on a wider array of self-concept facets than normally assessed, Shani-Zinovich (2008) collected data on 374 gifted students (62% male) and 428 non-gifted students (45% male), enrolled in regular (heterogeneous) 10th and 12th grade classes in the Israeli school system. Students were assessed on five facets of self-concept - the academic, social, personal, moral, and physical - using the Tennessee Self-Concept Scale (TSCS; Fitts & Warren, 1996) and Multidimensional Self-Concept Scale; (MSCS; Bracken, 1992). Significant effects for giftedness were found for four of the five subscales. By contrast, compared to their non-gifted counterparts, gifted students held higher academic and social but lower personal and physical self-concepts. No group differences were found on moral self-concept.

Reference group theory posits that self-perceptions in educational settings, such as self-concept, are shaped by the process of social comparison. The big-fish-little-pond effect (BFLPE), based on the basic assumptions and principles of the social frame of reference model (Marsh & Parker, 1984), has been used frequently in research as a highly influential heuristic scheme in researching the effects of academic frameworks on the development of self-concept in gifted adolescents. According to this model, self-perceptions in educational settings are largely shaped by the process of social comparison. With the increasing ability level of the reference group (school, class, etc.), students often compare themselves with high ability peers and are compared by their teachers with more intellectually able peers, which in turn affects the feedback (e.g., grades) students receive. Thus, the likelihood for upward social comparisons with more able students, as well as the likelihood to get lower grades, increases with ability level of the reference group. This, in turn, results in lower academic self-perceptions (for overviews see Marsh, 2005).
In order to test this model in the Israeli context, Zeidner and Schleyer (1999a) analyzed academic self-perceptions of gifted students in regular mixed-ability classes in addition to those in special gifted classes. The hypothesis was tested on a sample of 321 gifted students in special homogeneous gifted classes and 661 students in mixed-ability heterogeneous classes, with a one-day pull-out program. Overall, the findings of Zeidner and Schleyer (1999a) supported the BFLPE. A more recent study (Preckel, Zeidner, Goetz, & Schleyer, 2008) re-examined BFLPE using HLM methodology and also found support for the BFLPE for academic self-concept.

Another interesting aspect of non-academic self-perception of gifted children focuses on the perception of the individual’s emotional competency. Zeidner, Shani-Zinovich, Matthews and Roberts (2005) examined the emotional self-perception of gifted youth, aged 13–15. A self-perception questionnaire, the Schutte Self-Report Inventory (SSRI; Schutte et al., 1998) was employed in order to measure the perceived emotional competency of the participants, along with an emotional ability-based test, the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer, Salovey, & Caruso, 2002), designed to measure objective emotional intelligence. It was found that gifted youth perceived themselves as having lower emotional competencies, compared to their non-gifted counterparts. This finding was particularly striking due to the fact that emotional intelligence in practice, measured by the objective test, was higher among gifted students compared to youth not identified as gifted (Zeidner et al., 2005). These findings might indicate the necessity to strengthen perceived ability in non-academic areas among gifted students.

**Anxiety**

Do gifted and non-gifted students differ in anxiety? On one hand, it is plausible that high internal standards and success expectations in gifted adolescents, coupled with parental pressure for success and inordinately high social expectations, result in higher levels of state anxiety in gifted students. On the other hand, given the often-observed negative relationship between intellect and anxiety, gifted students may be lower on anxiety in view of their greater intellectual resources.

An early study of gifted students in Israel by Milgram and Milgram (1976) reported lower mean levels of general anxiety in gifted 4th through 8th graders, compared to their non-gifted counterparts. Furthermore, a significant interactive effect between gender and giftedness showed that gifted girls reported lower anxiety than non-gifted girls, but no differences in anxiety were found between gifted and non-gifted boys.

To test for group differences on both trait and state anxiety, Zeidner and Shani-Zinovich (2011) examined the effects of giftedness and gender on state anxiety components and four forms of trait anxiety, that is, social evaluative, physical-danger, ambiguous, and daily routine anxiety. Respondents were 374 gifted students and 428 non-gifted students, enrolled in regular (heterogeneous) classes in grades 10 to 12 in the Israeli school system. No effects for giftedness were found on any of the trait anxiety scales. By contrast, gifted students were shown to be lower in state anxiety levels, presumably because of higher intellectual coping resources allowing them to cope better with stressful encounters in academic situations.

Zeidner and Schleyer (1999b) were interested in examining differences between gifted and non-gifted students with respect to test anxiety. Data were collected on a national sample of 772 intellectually gifted students and 716 regular students in mixed ability classes in elementary and junior high schools throughout Israel. Gifted students reported that they were less test-anxious relative to their non-gifted counterparts across grade levels and gender groups.

These findings are consistent with the more general notion backed by some prior research that intellectually gifted students have a lower mean level of social evaluative anxiety than their regular counterparts, whether measured by self-report (Davis &
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Connell, 1985) or physiological indices (Wooding & Bingham, 1988). Furthermore, Zeidner and Schleyer (1999b) tested the BFLP effects for test anxiety. They reported that gifted students enrolled in a pull-out program showed lower mean levels of test anxiety compared to gifted students in homogenous gifted classes. Evaluative anxiety in academic settings may be generated by more or less veridical appraisals that failure is likely, due to low ability or lack of preparation and study. Accordingly, intellectually gifted students, who appraise their ability and chances for success more favorably, would be less prone to test anxiety. Thus, evaluative anxiety is shown to be of a dynamic character, being shaped, in part, by social comparison processes.

Mental Health

Given the ongoing debate over whether or not giftedness is associated with adaptive socio-emotional development and mental health, we set out to compare gifted and non-gifted same-aged individuals on subjective mental health, using validated measures and a representative sample (Zeidner & Shani-Zinovich, 2011). On one hand, it was reasoned that the high internal standards and success expectations in gifted adolescents, coupled with parental pressure to become successful, result in lower mental health in gifted students. On the other hand, given the negative relationship between intellect and N, coupled with the lower levels of N reported for gifted students, gifted adolescents may enjoy superior mental health, particularly in view of their greater intellectual resources. Overall, gifted and non-gifted students were not reported to differ significantly in mean mental health, that is, distress and well-being.

These findings, showing no significant differences between gifted and non-gifted adolescents on facets of mental health, are consistent with recent empirical work supporting the notion that gifted adolescents demonstrate similar (and often more healthy) psychological well-being to their non-gifted peers (Cross, Cassady, Dixon, & Adams, 2008). It appears that a number of factors may place gifted children at risk for unhealthy personality development (social stigma, asynchronous development, other-ascribed perfectionism, social pressure to succeed). At the same time, a number of protective factors (high cognitive ability, problem-solving strategies, problem-focused coping, self-understanding, high academic self-concept, openness, emotional stability) may mediate the impact of any potential adversity on these students and assure their development into competent and productive individuals (Gardynik & McDonald, 2005).

Follow-up Studies of Gifted Graduates

A number of important follow-up studies have been conducted in Israel tracking gifted students over time in order to assess their career success and life satisfaction during the adult years. For example, Malachi (1990) examined 400 gifted graduates, aged 30 on average. Participants were assessed retrospectively for their academic success in high school, military service rankings, pursuit of higher education, and chosen professions. Malachi found that adults who were identified as gifted during childhood had superior performance in a number of domains. Thus, they graduated from high school with higher grades than the general population; earned higher military rankings; the vast majority went on to institutions of higher education; and a significant proportion of gifted students majored in engineering and sciences and received higher mean academic grades. A remarkable finding was that 72% of intellectually gifted students graduated from the Technion, the highest institution for science and technology in Israel, ‘cum laude’, compared to the average of 25-30% in the general student body.

Gottfried (2006) examined life success among highly gifted individuals (99th percentile in identification score distribution) in the areas of higher education, occupation, and monthly
income. Intellectually gifted students were shown to be advantaged in all objective indices of life success. Similar results were obtained in other follow-up studies (Israelashvili & Adi-Rakach, 2008; Oren, 1996). Curiously, despite the fact that these gifted adults were objectively more successful than their non-gifted counterparts, they perceived themselves as being less successful compared to others. Levi-Zamir (2009) looked at the long-term influences of partaking in gifted classes on adults, aged 35–42. She found that, compared to non-gifted adults, gifted graduates scored higher on a number of achievement indices. However, self-report assessments suggested that gifted graduates reported lower level of life satisfaction than their non-gifted counterparts.

Conclusions

Overall, findings bearing on the personality and affective characteristics of Israeli gifted children are consistent with worldwide data suggesting that gifted children and youth share specific affective characteristics compared to their non-gifted counterparts (Shani-Zinovich & Zeidner, 2009). Data showing higher scores for gifted Israeli adolescents on the broad personality factor of Openness (O) to experience and lower scores on Neuroticism (N) are consistent with prior findings reported by McCrae et al. (2002). Thus, our research is consistent with prior studies suggesting that these personality traits may be common for gifted students when compared to their non-identified counterparts; however, more international research is required.

In addition, recent research has looked at two narrow-band personality factors, self-concept and anxiety. Thus, research in Israel shows that gifted students hold a more favorable academic self-concept than their non-gifted counterparts, but a less favorable social or emotional self-concept. In addition, gifted students tend to be lower in test anxiety and state anxiety, but not reliably discernible with respect to trait anxiety.

Contextual effects on affective states, mainly anxiety and self-concept, have been noted in both Israel and abroad. It seems that placing gifted students in special homogeneous classes for intellectually gifted can be a “double edged sword.” On the one hand it may enhance school achievement and scholastic skills, while on the other it may pose a serious threat to the child’s self-concept, especially if students are transferred from a context in which they ranked high in the grade distribution, to a context in which they need to compete with others who are either intellectually similar or superior to them. Program planners will need to carefully consider this “trade-off” in formulating policies for intellectually gifted students.

Data collected in the Israeli context showed no significant differences between gifted and non-gifted adolescents on mental health. This is consistent with recent empirical work (Cross et al., 2008). It appears that the risks that may accompany giftedness can be moderated by the resilience factors also associated with giftedness.

Moreover, studies aimed at assessing the life success of gifted individuals in adulthood support the claim that giftedness may be an indicator of one’s overall adjustment and success in society. Given the nature of intelligence as a stable attribute of the individual, it seems quite plausible that gifted children, identified for their high academic skills and for their high intellect, would also become highly achieving adults. Indeed, when the life success of gifted adults is assessed, the majority of studies in Israel indicate that gifted graduates show a higher level of life success.

However, one may ask if actual success in occupational achievement, military rank, and financial resources are the best means to assess success or adjustment in general. If we take a closer look at the findings among Israeli gifted children, we also notice that frequently gifted children and adolescents don’t perceive themselves as successful. Moreover, they don’t perceive themselves as happy and emotionally contented. Thus an important issue that needs to be taken into account is the link between life success as perceived by society and the individual’s well-being.
Additionally, the majority of the studies tend to focus on comparisons between gifted and non-gifted children or gifted students in different kinds of enrichment programs. It would seem to be equally important to further understand the unique subjective experience of being gifted, using in-depth interviews and qualitative assessments that allow us to probe further into the experience of gifted students vs. non-gifted students in various educational contexts and domains.

By and large, the bulk of research has been concerned with cognitive aspects of intellectually gifted students. The time has come to systematically map out the socio-emotional profile of gifted children across the globe, and take this into consideration when developing intervention and guidance programs for gifted students. Furthermore, until recently, researchers have focused largely on giftedness as a personal asset, with the potential problem areas of giftedness largely ignored. Accordingly, research has focussed on meeting the academic needs of intellectually gifted students instead of on studies that identify how to meet their socio-emotional needs and problems (Yoo & Moon, 2006). There is an urgent need for research into the socio-emotional characteristics and problems of gifted adolescents, particularly in view of the recent reports of alarming rates of school avoidance and poor school adjustment; low self-esteem, feelings of loneliness, isolation, dejection, emotional incapacitation; and feelings of alienation from the school and social environment (Silverman, 1993; Zeidner, Shani-Zinovich, Matthews, & Roberts, 2005).

More direct research is needed on numerous facets of the psychosocial development of gifted vs. non-gifted youth in order to better address the need for remediation, identification of problem foci and provision of interventions to help gifted adolescents cope with various sources of psychosocial stress related to the special characteristics of intellectually gifted students.

References


Gottfried, M. (2006). Follow-up study of those shown to be gifted on the psychometric examinations: The factors which lead to the actualization of their potential for success in life (Hebrew). Thesis submitted in partial fulfillment of the requirements for the master degree. Haifa: University of Haifa.


student self-concept: Is it better to be a relatively large fish in a small pond even if you don’t learn to swim as well? Journal of Personality and Social Psychology, 47, 213–231.


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The Talent Development Model: An African Perspective of Shona Culture

Constantine Ngara*

Abstract: While existing conceptions of giftedness and talent, assessment tools and models espoused in educational psychology are all grounded in the West, there are different ways to look at talent development (Ngara, 2010). This article presents the Dynamic and Interactive Process Model (DIPM) that explains how the Shona artists of Zimbabwe conceptualize the origins and development of talent in their domain. Two studies were conducted at two levels using different research designs: a) a cultural level seeking to highlight Shona culture's views of giftedness and talent, and b) an individual level seeking to understand how Shona artists conceptualized the origins and development of their talents. The initial study explored Shona culture’s views of giftedness through a questionnaire completed by 16 Zimbabwean academics of Shona cultural background. Data were analyzed in thematic frames. The second study was a grounded theory study conducted with 20 top Shona stone sculptors to generate a mid-range theory of how they conceptualized the origins and development of vision and inspiration in their art domain. The article elaborates on the possible application of the model in the educational context.

Keywords:
creativity, consciousness, giftedness and talent, inspiration, talent attributions, vision

Much as the Shona stone sculpturing art is able to speak beyond its cultural borders through the stone media, the Shona artists of Zimbabwe have demonstrated an intriguing consciousness of critical issues in human life. In an elusive search for the gifted personality to inform the pedagogy of giftedness from an African cultural perspective (espoused in Shona culture), this article discusses a model of talent development that emerged from studies on how the Shona artists of Zimbabwe conceptualised the origins and development of talent in art. Shona (also spoken in Mozambique) is the culture and language of over 82% of Zimbabwe's population, while 14% is Ndebele language and culture, and 5% is Whites, Asian and others. Zimbabwe (which means houses of stone in Shona language) is a Southern African state landlocked between South Africa (in the South), Mozambique (in the East), Zambia (in the North) and Botswana and Namibia (in the West).

To fully understand the cultural context of Zimbabwe’s stone sculpturing art on which the studies of the talent development model were based, it is important to note that the earliest known forms of stone sculpture of Zimbabwe were not art for its own sake (Mhonda, 2004). As established by Mhonda, the earliest known stone carvings of Zimbabwe (animals and birds including the Zimbabwe Bird – now the country's national emblem) were totemic representations of Mutapas (or Shona rulers). The Mutapas ruled a vast swath of land in Central and Southern Africa known as Munhumutapa Empire (Monomotapa by Portuguese historians' spelling), and its capital was Dzimbahwe (now called Masvingo ruins) in modern day Zimbabwe (Chigwedere, 1980; Mudenge, 1998). The ruins of stone houses (madzimbabwe in Shona language) are the relics of the ancient Shona kingdom that lie scattered in Central-Southern African countries. Meanwhile, the largest stone ruins are the Great Zimbabwe (Masvingo) ruins, formerly the kingdom's capital. That is where the earliest known stone carving relics of the ancient Shona kingdom were found.

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Although the Central-Southern Africa region is linguistically and culturally diverse, an exception is the Shona family of languages (or bantu languages) which are mutually intelligible, sharing similar grammatical structures and vocabulary (Campbell, 1968; Kolbe, 1971; Hombert, 1999; Mpofu, Ngara, & Gudyanga, 2007). In local languages, bantu (pl. case) means “people” while muntu (s. case) means “person” but as used in the English Dictionary, bantu describes indigenous people of Central-Southern Africa who share similar languages and culture. As noted by Mpofu et al. (2007), “Shona is also one of the most historically distinctive and widely dispersed languages in Central-Southern Africa ... speakers of Shona family of languages inhabit at least 14 countries in Central-Southern Africa” (p.227). Hence, it is believed that the Shona view of giftedness has wider comparability and applicability in the Sub-Saharan Africa region (Mpofu et al., 2007). Other than the geographic, historical and cultural context of the studies that inform the model of talent development discussed in this article, nowhere is it suggested or insinuated that the Shona people are more creative in art than other people in or outside Zimbabwe and the region.

As established in the initial studies on Shona culture’s views of giftedness (Ngara & Porath, 2004; Ngara, 2006), the stone sculptors of Zimbabwe were identified among the individuals presumed to be gifted in Shona society. In the same studies, it emerged that the Shona equivalent term for giftedness is chipo, a term derived from a common bantu verb root -p-(give) denoting the spiritual foundations of giftedness. In Shona as in all other bantu groups, giftedness is believed to be given by God. In Shona society giftedness is a blessing from Mu-ari (One-Who-exists) while among the Ndebele/Zulu the Giver is Unkulunkulu (the Greatest-One). In both the Shona and Ndebele/Zulu cultures giftedness is believed to be blessed in individuals through the mediation of their ancestors (Ngara & Porath, 2007). In this context, Ngara (2006) confirmed that bantu language groups’ equivalent terms for giftedness originate from the same verb root -p-(give), for example, chipo (Shona-Zimbabwe, Mozambique), isipho/isipwo (Zulu/Ndebele-South Africa, Zimbabwe), kipawa (Swahili-Tanzania, Kenya, Democratic Republic of Congo, Uganda), mpho (Sotho-Lesotho) and ukupelwa (Bemba-Zambia).

In other findings Ngara (2006) and Ngara and Porath (2004) established that the Shona language equivalent term for talent shavi/ushavi literally translates to “having a spirit for doing something.” Shavi/Ushavi expresses the power and intensity of emotional drive, inspiration or motivational energy that is often associated with talented individuals and eminent achievers. In Shona culture’s point of view, a student demonstrating exceptional desire to pursue academic excellence is described as having shave redzidzo (a spirit for academic achievement). In unmasking the notion of having a spirit for..., Ngara (2006, 2012) found that shavi/ushavi is paradigmatic expressing extracognitive phenomena from a cultural perspective. “Extracognitive” describes those “things that are not strictly cognitive” which are not directly controlled by individuals (Runco, 2004, p. 18). As elaborated by Shavinina and Seeratan (2004), extracognitive phenomena include specific feelings, specific beliefs, preferences and intuitive processes. Similarly, shavi/ushavi expresses the intensity level of energy and drive that propels gifted individuals to strive for exceptional standards. In this connection, our challenge as educators then, is to figure out how to arouse the spirit for excellence among students. Hence, this writer’s quest is to discuss a model that has promise to enrich the pedagogy of giftedness in nurturing students’ talents. As asserted by Ngara (2002),

Schools as socializing agents should not only concentrate on wilful development of children but should also strive for the fullest development of innate gifts and talents. Schools’ effectiveness should be assessed against their ability to identify and develop gifts and talent in children. (p. 214)

Although schools are thus mandated to develop students’ giftedness and talent, there is much debate on how we conceptualise giftedness and program for talent development in schools. While the Shona (and other bantu groups) regard giftedness as spiritual, this view has sparked much controversy and debate in gifted education (e.g., Dweck, 2006; Matthews & Folsom, 2009; Nelson, 1999). In particular, Matthews and Foster (2006) and
Matthews and Folsom (2009), in a paradigm shift, criticise the traditional (spiritual) view of giftedness as a ‘mystery model’ which is unprogressive; it limits individuals’ chances for talent development. As elaborated by Matthews and Folsom, the ‘traditional view’ of giftedness or ‘mystery model’ sets limits on who is selected into gifted programming, and hence, it is discriminatory and undesirable in gifted education. In this debate, a number of researchers (e.g., Dweck, 2006; Matthews & Foster, 2006; Matthews & Folsom, 2009), support the ‘mastery model’ on the grounds that it is developmental, open and progressive, and consistent with the dynamic nature of development. As argued by Dweck, the ‘mystery model’ is based on genetic causality while the developmental or ‘mastery model’ emphasises environmental contribution to development. The ‘mystery model’ is considered fixed throughout one’s life span – “once gifted always gifted” – however, educators have recently come to recognize the existence of variations in individual developmental styles and changes in educational needs across the school years. In this context, Barab and Plucker (2002) suggested that we should be focusing on improving learning contexts that nurture students’ giftedness rather worrying over its causality.

Consistent with Barab and Plucker’s (2002) views, the Shona cultural notion that every child is potentially gifted becomes a good reason for improving students ‘learning contexts’ to nurture giftedness. In essence, from a Shona culture’s point of view, teachers should refrain from writing off students as failures based on the results of intelligence testing. As argued further by Dweck (2006), while most people view “the ‘gift’ as the ability itself…what feeds it is that constant, endless curiosity and challenge seeking” (p.63). Indeed, there is a need to shift focus from the gift itself to supporting the emergent personality of giftedness. Hence, this article presents the dynamic interactive process model (Ngara, 2010) as a possible way of nurturing talent development among students.

Studies That Inform the Dynamic Interactive Process Model (DIPM).

The dynamic interactive process model (DIPM) emerged from previous studies that were conducted by this author at two different conceptual levels, cultural and individual. At the cultural level (Ngara & Porath, 2004), Shona culture’s implicit theories of giftedness were investigated in order to understand the Shona artists’ cultural consciousness that might be linked to creativity in their domain. Sternberg (1985) defines implicit theories as those that reside in people’s minds and are the basis for their actions. Shona culture’s implicit theories of giftedness were explored by a questionnaire completed by 16 Zimbabwean academics who are considered to be experts of Shona language and culture. Data were analyzed in thematic frames, using frequency tables to gauge a consensus of responses among the respondents. As highlighted earlier, the study established that in Shona society giftedness (chimp) has spiritual foundations and a community focus. Giftedness is believed to be blessed in individuals for the common good.

Although giftedness is said to be given to all at birth, its manifestation is also subject to certain conditions. It is believed to be lost to some by virtue of laziness, pride, selfishness, wickedness, greed, and disrespect for God and elders by either the individuals or their families (Mpofu et al., 2007; Ngara, 2010). These views represent part of the cultural consciousness that shapes the psyche of individuals, including artists raised in Shona culture. However, the question that needs to be examined is whether or not these views mitigate against talent development of individuals in this cultural context.

As the Shona artists were identified as some of the gifted individuals in society, their talent attributions were the focus in the study. Hence, at the individual level, a second study was designed to understand and establish how the top talented Shona artists conceptualised the origins and development of inspiration and vision in art (Ngara, 2010). The study adopted a grounded theory study approach to generate a mid-range theory of how Shona artists conceptualized the origins and development of talent in their domain. Data were collected and analyzed simultaneously through grounded theory study approaches using
a sample of 20 top stone sculptors (with a Shona cultural background) considered to be the icons of creative works in Zimbabwe.

**The Dynamic Interactive Process Model of Talent Development**

As established in the grounded theory study, creativity in art results from a dynamic and interactive process involving six major factors: inherent/internal factors, activation catalysis, individual’s unique experiences, practice/experience, cultural consciousness, and domain-specific consciousness. The study suggested a dynamic interactive process model (DIPM) that explains how the Shona artists of Zimbabwe conceptualised the origins and development of their talent in art. The DIPM model is a construct of the dynamic interplay of those six major theoretical concepts which emerged from the Shona artists’ talent attributions. Indeed, the phenomenon of creativity is both dynamic and complex (Wallace & Gruber, 1989).

The DIPM model (see figure1) as proposed in the study is not an attempt to simplify creativity but the model should be viewed as a simplified representation of a complex phenomenon. As shown in figure1, the DIPM model contextualises the major theoretical concepts that were linked to the dynamics of creativity in art by the artists. Based on the Shona artists’ life experiences and beliefs, the model suggests that creative potential is inherent in the individual but it requires an activation (or reactivation) catalyst that evokes one’s unique experiences, cultural consciousness and domain specific consciousness through interaction that leads to creative expression with practice/experience.

Although the artists expressed differing views as individuals, they were unanimous that talent developed from inherent/biological/personal factors. The artists argued that if one does not possess inherent talent potential, one cannot become a true artist. Some of the artists gave examples of many young and aspiring men and women who had been exposed to the field but failed to become artists. As asserted by one of the artists,

> Those who don’t have it give up so easily before they realize anything. They throw in the towel when going gets tough but those born artists soldier on and live in hope. I’ve seen many youngsters come here very keen and eager to try their luck but many of them so on left unceremoniously. (Ngara, 2010, p. 63)

![Figure 1. A dynamic and interactive process model of creativity: Shona artists’ constructions of the origins and development of inspiration and vision in art (Ngara, 2010, p.189).](image-url)
While the first generation artists (legends of modern stone sculpture of Zimbabwe) attributed talent development to inherited (mystical) factors, the third generation artists (mostly children of first generation artists and other young and upcoming artists) attributed inherent factors to both biological and personality factors. As asserted by one of the third generation artists, "If one does not have interest it won't work...what it actually means is that an individual has to have a cerebral underpinning for excellence" (Ngara, 2010, p. 64). In this connection, Thrash and Elliot (2003) asserted that the creative process involves "consciousnesses" or being mindful of qualities of goodness, beauty and aesthetics. Hence, it is ultimately an individual's personality that seems to make the difference in creating art.

As suggested by the artists, stimulating exposure to the domain played a part in the development of their inspiration and vision in art. As explained by a third generation artist, "I just think having come across those guys who were doing what I liked to do most in my life helped me immensely in the development of my talent.... ideas do not spring from nowhere..." (Ngara, 2010, p. 64). In other words, stimulating domain exposure acts as the catalyst that activates or reactivates the individual's inherent talent potential. This view suggests that individuals develop new ideas in art based on what they have experienced before. As confirmed by Langer (2005), familiarity increases domain liking that, in turn, is likely to evoke "mindful" engagement that produces creativity. Mindfulness describes "the process of noticing new things" (Langer, 2005, p. 16). However, as cautioned by Sternberg (2006), domain knowledge can operate like a double-edged sword with regard to creativity. While on the one hand it acts as a springboard of creativity, domain knowledge can also inhibit creativity by closed thinking when one fails to go beyond how one has seen the problem. Although the artists acknowledged the necessity of domain exposure, in corroboration with Langer (2005), they did not believe that it was a sufficient condition for talent development.

While in Shona culture, every child is believed to be born gifted, Shona culture also acknowledges that only a few individuals will truly manifest their giftedness because of some of the mitigating factors already discussed. In the study, the artists also acknowledged that some personal factors (whether inherited or not) play a significant role in spurring on some individuals to profit from exposure in art. As explained by artists, carving stone is not easy because it involves skills of craftsmanship and creativity plus patience and endurance. Although the artists believed in inherent talent, they also acknowledged that "expertise is developed through conscious intent – hard work and practice" (Ngara, 2010, p. 69). In addition, the artists mentioned practice and/or experience as important in the development of creative vision but they were also quick to say that practice and/or experience alone was not a sufficient condition for creativity in art. Also involved in the dynamic and interactive interplay of producing creativity in art are those unique personal experiences of individuals which in some ways explain their inspiration and resolve. If the sentiments of a third generation female artist are anything to go by, then, unique personal experiences and personality are critical in the dynamics that produce talent.

I used to be looked down upon as a woman and this aroused my desire to succeed and prove otherwise.... I won the first prize beating all those arrogant and bragging men much to their shame. My experience in New Zealand taught me that with serious determination, you can achieve anything, even entering Heaven. (Ngara, 2010, p. 71)

The six major theoretical concepts of the model identified above are supported in the literature. Mhonda's (2004) claim that "cultural consciousness of imagery is the basis of creativity through its quasi-religious emotion expressing Shona beliefs and mythology through solid imagery" (p. 41), is not unsubstantiated. However, his hypothesis of cultural consciousness is but one part of the dynamic elements involved in the DIPM model. Cultural consciousness means being mindful of cultural beliefs and value systems (Langer, 2005). Consistent with Mhonda's (2004) views of cultural consciousness, some of the third generation artists (children of first generation artists) explained their inspiration in stone sculpturing art as a family legacy or following the footsteps to wisdom.
at a national level, the new artists' inspiration and vision can be attributed to their cultural consciousness of Zimbabwe's stone sculpturing legacy. As part of cultural consciousness, women artists became inspired to join in stone sculpturing art in unexpected ways, most of which were reactions to their culturally prescribed gender roles to assert their freedom promised in art. As reported by one first generation female artist, she became inspired to join stone sculpturing art because of the humiliation by her husband who was one of the first generation legendary artists.

The DIPM model is based on the interviewed artists' belief systems with regard to the development of their talents. As corroborated by Perry (2005), commenting on creativity of writers, "Writers operate with a variety of belief systems" (p. 34). That belief systems are part of the psychological dynamics of creativity has been consistently confirmed elsewhere in research (e.g., Dewey, 1981; James, 1950; Walters, 2000). As further elaborated by Dewey, belief systems are part of the critical dynamics of creativity as they bridge the gap between the individual's inner experiences and the external environment.

In figure 2, the DIPM model is further simplified and contextualized into four major factors for application to promote talent development in schools. Using the DIPM model in figure 2, teachers can create opportunities for talent development (e.g., exposure/catalysis, practice, encouragement, evaluation), encourage students to use their personal factors (giftedness/intelligence, personality, unique experiences, passion), inspire students to evoke passion through cultural aspects (cultural consciousness), and develop the ways of knowing (e.g., academic needs, creativity, vision, and psychological needs).

Concluding Thoughts and Implications for Talent Development

From a social cognitive perspective (Bandura, 1986), the Shona artists' self-reflections, self-beliefs and cultural consciousness on which the DIPM model is based constitute cognitive processes mediated by self-direction. The views discussed in the DIPM model are all based on Shona artists' constructions of reality in their social contexts. Although the belief in inherent talent (as espoused in Shona culture) is criticised as a “mystery model”
seen as closed and unprogressive in gifted education (e.g., Matthews & Folsom, 2009), it
seems that in the context of the DIPM model discussed here, belief systems may not be
easily dismissed (Ngara, 2010). As discussed in the DIPM model, belief systems constitute
a cultural consciousness that is involved in the dynamics of creativity as corroborated
elsewhere in research (e.g. Dewey, 1981; Perry, 2005; Walters, 2000).
If the Shona cultural view that every child is potentially gifted were adopted in gifted
education, it would complement new thinking in research which emphasizes improving
students’ learning contexts to nurture talent (Barab & Plucker, 2002). In addition, if both
parents and teachers reinforce children’s self-beliefs about the existence of their talent
potential, this may, to some extent, help to develop children’s sense of self-direction,
confidence, and self-efficacy, which are some of the ingredients of a gifted personality.
Consistent with Ford, Grantham and Milner’s (2004) views, teachers with a dynamic view
of giftedness use students’ strengths to develop their confidence while those with a deficit
view label and differentiate students based on IQ test scores.
As asserted by Ngara (2012), some of the cultural beliefs and taboos in Shona culture are
paradigmatic, expressing scientific truths and psychological facts from a time before
people knew scientific jargon. Hence, some of those facts have stood the test of time. As
Shona culture ties the emergence of giftedness and talent to morality, it can be assumed
that Shona elders might have realized how negative personalities tended to mitigate
against an individual’s chances of success in life. As normal children would usually not
want to be associated with such vices as wickedness, laziness, selfishness, pride, and
disrespect of God and elders, the pedagogy of giftedness could also concern itself with
developing positive personalities in students with achievement-oriented ambitions. In this
regard, this article acknowledges the critical nature of personality factors in giftedness
and talent development.
As much as the social cognitive perspective emphasises environmental influences in
achievement motivation (Dai, Moon, & Feldhusen, 1998), what the DIPM model proposes is
constructivist. Beliefs are socially and cognitively constructed. Therefore, schools could
develop more enduring student beliefs about the existence of their talent potential.
However, this does not imply that belief systems can provide an easy formula for
encouraging the development of giftedness and talent. While beliefs, preferences,
intuitions, and feelings are part of the dynamics that produce creativity, they also
constitute extracognitive phenomena which we may not be able to directly influence
(Runco, 2004).
Although the views of talent development discussed in this article only focused on stone
sculpturing art by Shona artists in accordance with the focus and research design, future
research could investigate how the DIPM model based on the Shona artists’ views
compares with the talent development model based on other artists from a different
culture. In addition, future research could also investigate whether other artists (outside
stone sculpturing art) and different professionals within Zimbabwe share similar views of
creative expression with Shona stone sculptors.

References

The Author

Constantine Ngara is an Assistant Professor at University of Bahrain Teachers College. In his doctoral thesis (at University of British Columbia), he studied the Shona artists of Zimbabwe's talent attributions and proposed a dynamic interactive process model (DIPM) that explains talent development from an African perspective. His research interest is focused on understanding cultural conceptions of giftedness with a view to inform gifted education from a sociocultural perspective. His publications include book chapters, a book and several articles on giftedness and creativity.
Abstract: Starting with the premise that some gifted students are very difficult to identify, this paper defines the invisible gifted student to be a gifted student who is underachieving, in the sense that his or her measured potential is significantly less than his or her actual high potential, and this underperformance is reflected in all measures of potential and achievement used in the school context. The existence of invisible gifted students is shown through examples from five projects. The paper presents two socially and culturally sensitive methods of cognitive assessment, which have shown enormous potential for identifying invisible gifted students. Along the way, it is found that invisible gifted students often come from a background of disadvantage, are subjected to performance inhibitors that make it very difficult to excel in areas of academic talent, have low self-efficacy, are subject to enormous social pressures, have a lack of trust in the education system, have a fear of failure, and are struggling in their search for self-identity.

Keywords:
gifted, invisible gifted, gifted students who underachieve

Introduction, and a Caveat …

And this implies – casting all false impartiality aside – that [we] must concentrate first on the lower and lowest levels of human society. The poor, the socially and economically weak and threatened will always be the objects of [our] primary and particular concern. (Barth, 1934, p. 1)

In the title to this special edition of Talent Development & Excellence, the search for the “gifted personality” is described as elusive. On the one hand, this could be taken to mean that the personality of the gifted person is difficult to find (in the sense of to understand and to describe). If, as Jamison (2005) argues, personality is an expression of an underlying temperament or essential characteristic of an individual, many elements will have an impact on how personality is expressed, and indeed the extent to which personality is expressed. On the other hand, the elusive search for the “gifted personality” could be taken to refer to the process of first identifying giftedness, and then exploring ways to best support the development of ways in which this giftedness might be expressed. In either case, sometimes giftedness is very well hidden.

When most people think about giftedness, they tend to think of a child who is usually highly motivated and who is achieving at a high level at school. That is, there is a common perception that our schools are providing well for the needs of the gifted child. However, according to an Australian senate report in 2001, gifted children do have special needs within the education system, and for many these needs are not being met. “Many suffer underachievement, boredom, frustration and psychological distress as a result” (Commonwealth of Australia, 2001, ¶ 1.1). Gifted children from backgrounds of disadvantage are particularly at risk of falling significantly short of realising their potential.

Here, a “background of disadvantage” can mean many things, depending on the educational context. It may refer, for example, to low socio-economic status, to cultural
minority status, to refugee or immigrant status, to rural and isolated communities, or to the juvenile justice system. Here we must be careful, and sensitive, not to interpret “disadvantage” in terms of a deficit model. Rather, we need to focus on the advantages of the social or cultural context. It is not simply a matter of being socially and culturally aware. We need to be socially and culturally proficient (sensu Lindsey, Roberts, & Campbell Jones, 2005), to see diversity as a benefit, to honour differences, and to interact knowledgeably and respectfully with others.

Gifted Students who Underachieve

For the purposes of this discussion of invisible gifted students, Gagné’s (2008) Differentiated Model of Giftedness and Talent (DMGT) is adopted as a conceptual framework. Gagné’s model describes the dynamic relationship between high potential and high performance. He refers to giftedness as natural ability or aptitude, and he refers to talent as outstanding mastery or competency. Gifts are transformed, or not transformed as the case may be, into talents through a talent developmental process. Hence, importantly, the DMGT is inclusive of the gifted student who is underachieving. That is, the adoption of Gagné’s model carries with it the responsibility of identifying not just high achievement but high potential in students. It also means that there will be an appropriate educational response in order to translate this high potential into high performance.

Following Funk-Werblo (2003) and Chaffey and Bailey (2006), let us now define the gifted student who underachieves to be a student whose school performance is significantly below some measure of his or her high potential. Let us also define the invisible gifted student to be a gifted student who is underachieving, but whose measured potential is significantly less than his or her actual high potential, and this underperformance is reflected in all measures of potential and achievement used in the school context.

It is claimed here that gifted children from backgrounds of disadvantage are particularly at risk of being invisible gifted students. Teachers usually perceive these students to be average students, and this tends to be reflected in all measures of their achievement at school. This suggests, of course, that “underachievement” may in fact be the wrong term, as it places the onus on the student when the cause, or at least the responsibility, lies with the education system (Funk-Werblo, 2003).

Several factors may contribute to the development of underachievement by a gifted student, and these are related to school, the social milieu, the social and cultural context, and to issues related to the search for identity (Ashman & Merrotsy, 2011). First, within a school, giftedness may go unidentified, unrecognised and unacknowledged; school circumstances, school structure and organisation may be inflexible; the classroom environment may be rigid; and there may be a general lack of resources. Second, the child may live in a milieu that presents an anti-gifted stance and an anti-intellectual atmosphere, with differing beliefs and value systems, steeped in prejudices. Third, the child may lack cultural capital (beliefs, values and language) or lack social capital (social relationships and networks, social norms and values, and trust), may live in poverty or in isolation, and may lack choice. Fourth, the child may lack trust, have a fear of failure, be struggling in their search for self-identity, have low self-efficacy, be subject to the forced choice dilemma, or have a psychopathology. Two of these concepts in particular, low self-efficacy and the forced choice dilemma, appear to be consistently present in gifted students who underachieve.

Low Self-Efficacy

Self-efficacy is closely related to the ability to plan and to achieve desired outcomes. If we believe that we cannot achieve a desired outcome from actions, we have little or no motivation to act or to continue to act when faced with adversity. Hence self-efficacy influences the choice of task, the amount of effort made, the level of persistence with the task, and what is actually achieved. Therefore, according to Bandura (2003), students with
low self-efficacy will resist engaging in learning because they believe that, no matter how hard they try, they will not succeed. Gifted students from backgrounds of disadvantage are particularly at risk of having low self-efficacy.

The Forced Choice Dilemma

The second of the key elements that impacts most on talent development is the forced choice dilemma. The forced-choice dilemma is described by Gross (1989, 1998, 2004) to be the choice that gifted young people often have to make between excelling in an area of talent that is not valued by the peer culture, and being accepted by that peer culture. If there is a primary need to form or maintain relationships with age-peers, the intellectual potential or interests will be masked so that the person can conform to a value system that may be markedly at odds with their asynchronous development. Because of the forced choice dilemma, many gifted children from backgrounds of disadvantage will, either consciously or unconsciously, maintain their status of “invisible gifted students”.

Invisible Gifted Students

Ut saepe summa ingenia in occulto latent.

(Sometimes the greatest genius is hidden in darkness. Titus Maccius Plautus, Captivi, I, 2, 62)

Given that the underperformance by invisible gifted students is reflected in all measures of ability and achievement used in the school context, including the most commonly used tools for identifying gifted students, their identification is a significant issue. In typical school contexts, these students are not identified to be gifted; indeed, they are not even identified to be underachieving. Furthermore, even in so-called “culturally fair” tests of ability (for example, see Naglieri & Ford, 2003; Shaunessy, Karnes, & Cobb, 2004), such as the non-verbal Raven’s Standard Progressive Matrices (RSPM; Raven, Raven, & Court, 2000) and the Naglieri Nonverbal Ability Test (NNAT; Naglieri, 1997), the invisible gifted student will tend to perform at a level similar to their level of achievement at school (Chaffey & Bailey, 2006; Merrotsy, 2006).

Some might question whether such gifted students exist. However, sometimes these students “provide glimpses of their academic potential, giving rise to gut feelings in teachers that these children have more to give” (Chaffey, 2002, p. 2). Such gut feelings have suggested to some researchers that dynamic assessment or dynamic testing may offer, at least to some extent, a means of identifying the potential of the invisible gifted student (cf. Sternberg & Grigorenko, 2002). Certainly, very careful methods do need to be used. What appears to be required is first an assumption that invisible gifted students exist, and then an attempt to address the perceived causes of the underachievement so that the child is able to perform at a level closer to their cognitive ability (Merrotsy, 2006).

In the following sections, an overview of the current status of research on invisible gifted students will be presented. An advanced search was conducted using all of the database search engines in the author’s university library, restricted to articles reporting the findings of formal research in refereed publications and published since 2000. This search resulted only in several Australian publications by Chaffey, by Merrotsy, and by several of Merrotsy’s research students. Presentations by the author at international conferences have not been able to locate anyone else conducting research in this area.

Klich’s (1983) Assessment of Visual Memory

One successful method, developed by Klich (1983) to investigate individual differences in cognitive functions amongst Aboriginal and non-Aboriginal Australian children, appears to have been completely overlooked by subsequent researchers and the related literature. Klich (1983) applied Luria’s neuropsychological theory of functional organisation to structure a measure of visual memory. The children in his study, sampled from desert Aboriginal and rural white Australian communities, may have interacted...
differently with the various task characteristics, such as mode of presentation and type of required memory skill, but for the two cultural groups there was no significant difference in the levels of performance for the task as a whole.

**Chaffey’s (2002) Coolabah Dynamic Assessment**

Chaffey’s (2002) Coolabah Dynamic Assessment (CDA) model is a quantitative measure that comprises a pre-test, which uses RSPM; an intervention, which intends to be culturally appropriate and to address the perceived causes of underachievement, and attempts to optimise cognitive performance; and a post-test which again uses the RSPM. The intervention includes an icebreaker, to establish trust and to create a non-threatening environment, and a metacognitive intervention. The metacognitive intervention addresses perceived cognitive and socio-emotional issues: it is designed to enhance the self-efficacy of the child towards CDA learning tasks, to develop metacognitive knowledge and control, to address cognitive and affective development, and to ensure mastery (constant success) through scaffolding supported by performance and attributional feedback.

It should be noted here that CDA does not claim to assess learning potential, neither in the sense of the term for Kanevsky (2000), nor for Grigorenko and Sternberg (1998): after all, there is no real indication of a starting point from which to measure increase in learning or rate of learning, and there are no appropriate norms for the re-administered RSPM. In fact, given the high correlation between performance in the pre-test and in measures of achievement at school (Merrotsy, 2008), there would appear to be a strong case for not including the pre-test in the assessment model. However, if the RSPM is administered, and then re-administered at a later date, a child would be expected to perform slightly better in the second test due to some level of familiarity with the test items (Sternberg & Grigorenko, 2002). If the metacognitive intervention really does address causes of underachievement, then a child achieving to their potential should still perform slightly better in the second test, whilst an underachieving child should make considerable improvement. Hence, CDA gives an indication of academic potential when the perceived barriers to learning have been removed (Chaffey, Bailey, & Vine, 2003; Chaffey & Bailey, 2006).

The CDA model has been effectively applied with underachieving gifted Aboriginal children and with underachieving children in very low socio-economic communities in Australia and Canada, and this is illustrated in the following two examples.

**The Wii Gaay Project**

A three-year study by Merrotsy (2006, 2008, 2011a; Clark & Merrotsy, 2008) examined the effectiveness of the *Wii Gaay* project, a community project run by the Armidale Catholic Schools Office in New South Wales, Australia. *Wii gaay* means *clever child* in the Gamilaraay language. The primary purpose of the project is to identify gifted Aboriginal children at an early age (Year 3, or about 9 years old) and to establish long-term provision that will enable them to attain their academic potential at school. The project has three components: effective, quantitative and culturally appropriate identification; appropriate intervention and long-term provision; and community involvement.

First, *Wii Gaay* uses Chaffey’s (2002) CDA model to identify gifted Aboriginal children in the northwest region of New South Wales. During the three years of the study, 48 children (approximately 15% of the total of the three cohorts of Aboriginal students in this school system) were identified to have high learning potential, and of these 47 participated in the intervention stage of the project (Merrotsy, 2008).

Second, for two school years, these children attend four camps and are involved in an ongoing school-based program that includes an independent research task each term. The provision addresses cognitive development (literacy, numeracy, ICT, metacognitive skills)
and affective development (building self-efficacy, building relationships) through integrated learning set completely within the cultural context of the children.

Third, underpinning every aspect of *Wii Gaay*, from initial planning and development, to the identification process, to the implementation of its programs (the camps and the ongoing school-based provision), is community involvement. This is necessary if outcomes for the children are to be maximised. The project therefore includes members of the local and wider Aboriginal communities. This involves Aboriginal parent and community consultation, community awareness days, gaining ethics approval from the communities, and the participation of adult Aboriginal role models, adult Aboriginal mentors, Aboriginal Education Officers, and Aboriginal Education Assistants.

Specific strategies are then employed in a long-term intervention programme that addresses the perceived causes of underachievement in the identified children so that they may attain their academic potential at school. It is implemented in two ways, through camps and through on-going activities in school, and it is important that these two components are essentially related. The children are involved in enjoyable activities in a safe, comfortable and pressure free environment, and with a focus on intrinsic motivation through mastery and self-efficacy enhancement. The activities develop a positive attitude towards learning by establishing trust, increasing metacognitive knowledge and control, addressing cognitive and affective (both social and emotional) development, and ensuring constant success through scaffolding and supported by performance and attributional feedback. The programme also provides peer role models and adult mentors, and includes school development and teacher professional learning.

At the end of the three years of the study, Merrotsy (2008) found that the children who participated in the project had made modest academic gains in state testing, but that these gains were significant when compared with state averages both for Aboriginal children and for all children in the relevant school year cohorts. For the children involved in the project, the study also showed a much higher participation rate in school (the absentee rate for the children dropped from 30+% to 3% after two years), and a high rate of engagement in classroom activities and homework. Importantly, the children were positive about learning, had like-minded friends (for many, for the first time since they started school), were happy, and loved being “Wii Gaay kids”.

Here it must be stressed that, of the 47 children who participated in this study, not one was identified to have high learning potential using any of the usual measures of ability and achievement used at school. Only one of these children (2% of the participants, but less than 1% of her actual cohort) scored at or above the 85th percentile in the RSPM pre-test. 45 of the participants were identified to have high learning potential only after completing the CDA intervention and the RSPM post-test. And, as a salutary warning of how difficult and sensitive identification of invisible gifted children can be, one of the participants was in fact not identified in the CDA process (Merrotsy, 2011a). In the RSPM pre-test she performed at the 30th percentile and in the RSPM post-test, after the two-hour metacognitive intervention, she performed at the 60th percentile. However, three months later, she was accidentally administered the RSPM again, as a far post-test, in which she performed at an extremely high level in the two hardest subscales of the test, and on this basis was included in the *Wii Gaay* project. As it turned out, her inclusion was most appropriate.

**The Lighthouse Project**

A two-year study by Cannon, Harding, Merrotsy and Ryan (2008) explored academic underachievement by gifted children enrolled in an independent school system in a very low socio-economic area of New South Wales, Australia. In particular, this study examined the outcomes of the *Lighthouse* Project, which aimed to identify invisible gifted children and to reverse their underachievement at school through an intervention involving the
children, their parents and their teachers. Quantitative and qualitative data were collected to evaluate the implementation of the project model, the extent to which the children's academic achievement improved, and the influence of family dynamics on the realisation of potential.

Chaffey's (2002) CDA model was used to identify gifted children who were underachieving at school. The CDA identified 32 children, or 14% of the Year 3 cohort of 230 students, to have high learning potential, and of these 31 participated in the project. It is important to note that in the pre-test, using Raven's Standard Progressive Matrices (RSPM), only four of these children performed in the top 10% of their Australian age norms. An intervention, set within the conceptual framework of Rimm's (2003) Trifocal Model and the Chaffey Provision Model (Cannon, Harding, Merrotsy, & Ryan, 2008), then addressed the perceived causes of the underachievement to help the children succeed within the school system. The intervention emphasised individual engagement in learning through the development of self-efficacy, the provision of vicarious experiences, and the experience of mastery and individual success. This was accomplished by student participation in camps and in on-going programs and individual projects. These activities were supported by the involvement of parents as well as Year 10 and Year 11 students. The intervention also included: parent workshops and evening programs; on-going liaison with individual parents; regional and school level teacher professional development; and liaison with the schools and with the individual classroom teachers of the children participating in the project.

The themes that emerged from the qualitative data highlight the importance of collecting quality information about students throughout the Primary school years. First, the camps reinforced the notion that, in order to address the learning needs of invisible gifted children, academic self-efficacy must first be enhanced. They also highlighted the need for a careful consideration of the individual child's zone of proximal development. Only then can student engagement and motivation be improved through a subtle balance of the level of challenge with the level of developed skills of the individual child. Second, high but realistic teacher expectations, good teacher relationships with their students, the use of specific strategies to increase student self-efficacy, engagement and effort, and the use of teaching strategies such as pre-testing and scaffolding, were significant predictors of improved student learning. Third, monitoring and tracking change in the learner, affirming positive change, and sensitively communicating this to both the child and their caregivers, are important for success at school. Fourth, the parents of the participants benefited from strategies that assisted them to provide a positive learning environment that enhances their child's self-efficacy.

Academic gains were measured by improved attendance and participation in school, increased engagement in learning activities and meeting learning outcomes, and improved scores in classroom achievement tests and external literacy and numeracy tests, all supported by data on school reports and interviews with parents. The data showed a significant improvement in effort (but not yet in achievement) for about 20% of the participants, and a significant improvement in achievement (but not necessarily in apparent effort) for about 30% of the participants. After nearly two years of intervention, the teachers involved in the project identified about a quarter of the participants (8 out of 31) who were now demonstrating what they termed "emerging signs of giftedness" (in Gagné's, 2008, sense of the term giftedness).

The Lighthouse Project also considered intergenerational issues related to underachievement by gifted children. For this aspect of the project, Harding (2008) investigated three issues. First she reviewed the influences that living in a low socio-economic area has on the family environment. Second, she studied the influences of family dynamics on gifted individuals, because self-concept, self-efficacy, achievement, motivation, values and attitudes are all influenced by the family environment and parental attitudes. And third, she explored the extent to which the parents of underachieving gifted children may also be "gifted underachievers" themselves.
To do this Harding (2008) developed four case studies resulting from narrative inquiry into the life experiences of four women. The findings, arising from an interpretative analysis of these case studies, highlight the deleterious effects of negative family environments, disruptive family types and female stereotyping on intergenerational synergy. She found that, for the 31 families involved in the project, there was a high proportion of single parents (both widowed and divorced); a high proportion of parents with a history of abuse as a child, and current chronic illness and mental health problems; and a high proportion of parents and children with anxiety related disorders.

Harding (2008) also found evidence for the cyclical nature of intergenerational dynamics. Deprivation and neglect within the family environment lead to underachievement. Parents brought up in poverty, with very low income, and a lack of resources and opportunities, tend to bring their own children up in a similar environment. Families experiencing financial difficulties within negative emotional and intellectual environments can lead to academic underachievement by the children. A parent's lack of provision of a stimulating learning environment, and poor role modeling of the values of learning and education tend to reflect their own childhood experiences. The unwanted, abused or neglected gifted child has little reason or encouragement to achieve academically. A differentiated family type will have a negative effect on achievement, especially if it is volatile, inconsistent and abusive. On the other hand, an integrated family type and consistency in parenting are conducive to create a positive learning environment and academic achievement if supported by a stimulating home environment.

It is worth highlighting here that in the Lighthouse project only 4 students out of a total of 230 in the cohort (i.e. less than 2%) were identified to have high learning potential either by measures usually used in the school context or by a one-off RSPM test. The other 27 participants in the project (about 12% of the cohort) were identified to have high learning potential only by using a model of dynamic assessment; they were not identified to be gifted by any of the other measures, including a one-off RSPM test, used in this study or in their schools.

The Subhaga Daruwan Project in Sri Lanka

Given the two examples above, the question naturally arises about the extent to which such a model of dynamic assessment has wider application. To be sure, CDA has been successfully applied with Aboriginal children in Canada (Chaffey, McCluskey, & Halliwell, 2005). However, even without knowing the fine details of the CDA (on completion, Chaffey, 2002, was placed under an embargo for seven years), it is quite feasible to apply its broad principles and to take into account specific social and cultural considerations for each specific context, as is shown in the following example.

In a large Sri Lankan study called Subhaga daruwan, Ariyaratne (2008) developed a 360-degree assessment and feedback model to identify intellectually gifted and academically talented children. About 450 Primary Grade Four students from the Colombo district of Sri Lanka participated in this study. Quantitative data were collected in the form of scores from achievement tests, an above level test (the national scholarship examination for a higher grade), Gagné’s Tracking Talents Forms A & B (which cover teacher, peer and self nominations) translated into Sinhala, and Rogers’ Parent Inventory for finding Potential, modified and translated into Sinhala. The quantitative data were supported by qualitative data in the form of interviews of selected students, parents and teachers.

The researchers in Subhaga daruwan then attempted to identify invisible gifted students by implementing a form of dynamic testing developed specifically for the Sri Lankan context (Ariyaratne, Merrotsy, Smith, & Graham, 2008). A pre-test comprising RSPM was administered to an experimental group and a control group formed using matched sampling of the students not identified to be gifted by any of the other measures used in the study. The students in the experimental group who did not score above the 85th percentile (using the British and the Indian norms as a guide) underwent a metacognitive
The items used in the intervention were drawn from Feuerstein, Rand and Hoffman’s (1979) Learning Potential Assessment Device (LPAD) supplemented by items appropriate for the Sri Lankan context. These items were presented in a way that developed self-efficacy through careful scaffolding, ensuring mastery at each step, and appropriate performance and attributional feedback. The control group received a placebo intervention. The RSPM was then re-administered both as a post-test and, several weeks later, as a far post-test.

While the ANOVA test showed that the (expected) increase in scores for the control group was not significant, the increase in scores for the experimental group, in both the post-test and the far post-test, was remarkable. In the post-test, 34% of the experimental group performed at or above the 85th percentile, and in the far post-test most of these students maintained this performance. Indeed, one student, who scored below the 10th percentile in the pre-test, attained a score above the 95th percentile in the post-test and above the 90th percentile in the far post-test.

That is, and again it is appropriate to emphasise this, 5% of the participants in Subhaga daruwan were invisible gifted children before the dynamic assessment intervention: they were identified to have high learning potential only by using a model of dynamic assessment; they were not identified to be gifted by any of the other measures, including a one-off RSPM test, used in this study, or any of the measures of ability and achievement used in their school system.

**Identification of High Ability in the Creative Visual Arts**

So far, the examples given relate to the existence and identification of invisible gifted students with high potential in the intellectual domain. The following example hints that invisible gifted students may well be found with high natural abilities in other domains as well.

A small study conducted by Brockwell, Brooks and Merrotsy (Brockwell, 2008) used Urban’s Test for Creative Thinking – Drawing Production (TCT-DP; Urban & Jellen, 1996) as a central component of a holistic model to identify young children with high potential in the creative visual arts. Urban’s TCT-DP requires the completion of two drawings in response to given “figural fragments”. The TCT-DP construct comprises a set of fourteen criteria that inform the test design and also serve as the evaluation criteria. These criteria include continuation, completion, new elements, connectivity, boundary breaking, perspective, humour, emotion, expression and unconventionality. The test has been normed for various age and ability groups. Data from the TCT-DP were triangulated in three ways: teacher evaluation of student achievement in Visual Art, accessible from school and class records; a collection of work samples from the group of students, including “commissioned” works of a still life, an imaginary creature in its habitat, and feelings; and informal interviews with a purposive sample of students and their teachers. Using all of these measures, creative artistic skill can be readily placed within Urban’s (2004) six stages of creative growth or levels of creativity.

The participants in the study comprised 42 Stage 1 (Years 1 and 2) primary school students and three teachers from two small rural communities in New South Wales, Australia. The study found that three of these students (about 7%) were able to complete age-appropriate high-quality, detailed works of art, incorporating new elements to contribute to a holistic composition with a common meaning or theme, which placed them at the highest level of Urban’s (2004) stages of creative growth. Of particular interest here is that one of these students, Pic (a pseudonym chosen by the student), was not previously known to have high creative artistic ability, a fact reinforced by his classroom teacher, his previous teacher and his parents. After the study was completed, Pic’s high potential was communicated in a sensitive way to the student, his parents and his teacher, and his teacher subsequently addressed his specific learning needs in her classroom programming. Six months later, in a follow-up to the study, in which the teachers were
again interviewed and data from school reports were obtained, it was found, *inter alia*, that Pic was more engaged in all classroom activities and was achieving at a much higher level than previously in most subjects including literacy, numeracy and art.

**A Holistic Model for Identifying the Invisible Gifted Student**

One of the problems that school systems have found with applying CDA, robust as it may be, has been the cost of its implementation (in several senses of the term, such as the cost of the program and training, teacher release time, and time to administer the intervention). An Australian instrument, CogState, now over ten years old and hence apparently overlooked by researchers in "gifted education" until now, is showing enormous promise and flexibility in identifying invisible gifted students from a very broad range of social and cultural contexts. The following example successfully applies this instrument as part of a holistic model of identification of high ability in students in rural Australia.

As part of the Schools in Partnership (SiP) program, a twelve-month study was conducted in three very low socio-economic communities in rural New South Wales, Australia, with the aim of developing a holistic model to assess cognitive ability, including identification of high learning potential, in this context (Merrotsy, 2011b). The participants in the study comprised: 30 Stage 2 primary school students, 90% of whom were Aboriginal; 100 Stage 4 high school students, 40% of whom were Aboriginal, and all of the Aboriginal students in the feeder or partner primary schools; and 100 Stage 4 high school students, 25% of whom were Aboriginal, in a relatively isolated community.

The instruments used in the study were chosen with the aim of assessing cognitive strengths, as well as areas of learning weakness or difficulty related to possible underachievement. The instruments comprised:

1. an assessment of fine motor skill development, adapted from the Breuer-Weuffen Differentiation Test (Stoeger, Ziegler, & Martzog, 2008; Martzog, personal communication, December 2010);
2. an assessment of creativity, adapted from Urban's TCT-DP (Urban & Jellen, 1996);
3. an assessment of rate of reading under various lighting conditions (Wilkins, Jeanes, Pumfrey, & Laskier, 1996);
4. an assessment of visual memory, adapted from Klich (1983);
5. CogState (Cairney & Maruff, 2007; Dingwall & Cairney, 2010).

CogState (Cairney & Maruff, 2007; Dingwall & Cairney, 2010; see also www.cogstate.com) is computer-based software that assesses cognitive ability and cognitive state using validated tests of memory, attention and executive function. It was developed by the Menzies School of Health, Darwin NT, Australia, and is available in English (for Australia, England, and the USA), German and Dutch, although in other languages only a brief translation of rules suffices. It is low cost, requires little training to use it, takes about 30 minutes to administer (one-on-one), and is effective even with people who have never used a computer.

The study found that about 5% of the participants had poor fine motor skills and average achievement in school-based tasks, but also showed some signs of high ability (but not necessarily giftedness) in isolated areas, such as facility with language or with information and communication technology. Similarly, about 5% of the participants showed significant decreases in rates of reading over a short span of time in typical classroom lighting conditions. Both of these findings would suggest possible significant underachievement by these students, and, whilst not directly related to underachievement by gifted students, should clearly be taken into account when identifying invisible gifted students (Merrotsy, 2011b).

The study also found that CogState was able to identify (at least some) invisible gifted students, and that the proportion of gifted students from backgrounds of disadvantage,
identified using the holistic model, was not significantly different from the proportion of gifted students from the wider population (Merrotsy, 2011b).

**Conclusion**

The espoused purpose of the series of articles in this special edition of the journal is to search for, and, if it can be found, perhaps to explore, the elusive “gifted personality”. One problem with such a quest is that there might be as much variation in personality within the “gifted population” as there is across the whole population. Certainly the most elusive of those with high natural ability are those whom we call the invisible gifted. By their very definition, their high potential is not measurable by any of the usual measures of ability typically used in school systems.

Invisible gifted students tend to be, but will not necessarily be, from a background of so-called disadvantage. They are subjected to performance inhibitors that are powerful motivators for not participating in school, for not engaging in learning, and for not excelling in areas of academic talent. They have low self-efficacy, have a lack of trust in the education system and in their teachers, have a fear of failure, are struggling in their search for self-identity, and are subject to enormous social pressures such as the forced choice dilemma. Consciously or unconsciously, they mask their abilities and appear to all intents and purposes to be typical or average students, not standing out in any way (although, perhaps rarely, as we have seen, some are in fact achieving at a very low level).

If high learning ability goes unrecognised, educational opportunities and experiences necessary for optimal development will probably not be provided, which, for many students, results in underachievement, boredom and frustration. Given such an elusive “gifted personality”, the issue of identifying the invisible gifted student is indeed problematic. Socially and culturally sensitive methods of cognitive assessment, such as Chaffey’s (2002) Coolabah Dynamic Assessment model, and Merrotsy’s (2011b) holistic model incorporating CogState, have shown that invisible gifted students do exist. Appropriate identification of high potential, appropriate recognition, and appropriate educational intervention will result in educational participation and academic engagement, and have enormous benefits for affective development. These are the first steps for the invisible gifted student to become successful at school.

we do not believe in ourselves until someone reveals that deep inside us is something valuable, worth listening to, worthy of our trust, sacred to our touch ...

once we believe in ourselves we can risk curiosity, wonder, spontaneous delight, or any experience that reveals the human spirit. (e. e. cummings)

**References**


Barth, K. (1934) *Against the Stream*. Zürich, Switzerland: TVZ.


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Many Faces of a Gifted Personality: Characteristics Along a Complex Gifted Spectrum

Mimi Wellisch¹* and Jac Brown¹

Abstract: This article will explore previous attempts to categorise gifted children according to certain types, and examine attempts to find common gifted characteristics, including characteristics that may have resulted from adverse environmental and other influences affecting attachment security. The discussion will highlight the difficulty in identifying gifted children who have associated disorders, and propose that disorders can affect core gifted characteristics. If this were the case, then seemingly discrepant and unexpected behaviours in some gifted children may be explained by such disorders. It will be argued that characteristics can be reliably used to initially screen children for both giftedness and for more commonly associated disorders, including anxiety and ADHD. A screening tool, The Spectrum of Gifted Characteristics, includes characteristics of disorders more frequently associated with giftedness, characteristics associated with attachment, and predicted gifted characteristics when combined with separate disorders and attachment styles.

Keywords:
personality, gifted spectrum, attachment, disorders, gifted characteristics, gifted identification, Theory of Positive Disintegration, twice exceptional children, maternal depression

The term personality is generally thought of as a dynamic and organized set of characteristics that uniquely influences a person’s thoughts, feelings, motivations, behaviours (Ryckman, 2004), that are heritable and relatively stable by the age of 30 years (Costa & McCrae, 1992). However, recent research challenges the importance of such heritability, and even the stability at age 30 (Roberts, Walton, & Viechtbauer, 2006). For example, irritability, an aspect of neuroticism (McCrae, Costa, & Busch, 1986) and previously thought to be heritable, appears to be caused or called forth by maternal stress during pregnancy (Prior & Glaser, 2006; Rice, Jones, & Thapar, 2007). Caspi et al. (2003) have also produced evidence of gene x environment (G x E) interaction. It may, therefore, be more accurate to theorise that there are heritable personality tendencies that are either more or less receptive to environmental influences. How to identify the optimum environment that eventually helps create the gifted personality, or how to define giftedness itself are subjects yet to reach consensus amongst scholars. Freeman wrote in 2005 that there were more than one hundred suggested models of giftedness, and more have since been proposed. Gifted identification has also been difficult (VanTassel-Baska, 2005), not least due to the diversity found amongst gifted children, going some of the way to explain why defining the gifted personality has been so elusive.

This article will explore some of the attempts to define specific gifted personalities, and examine a variety of characteristics associated with giftedness including those that can be environmentally derived or influenced. Such characteristics, based on research, could be reliably used to initially screen children for both giftedness and the more commonly associated disorders. We will also argue that the diversity of characteristics, shaped by environmental and other factors, make up a spectrum of giftedness. To begin, let us take a brief look at some attempts to group children into gifted types in order to enable recognition of particular needs.

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Gifted Types

Roep (1982) suggested five types of gifted children. The types, based on their emotional needs, were the perfectionist, the child/adult, the winner of the competition, the self-critic, and the well-integrated child. Betts and Neihart (1988) suggested a theoretical concept of six recognisable profiles of gifted children that included their behaviour, feelings and needs. Their profiles were recently updated (Neihart & Betts, 2010) and are the successful, the creative, the underground, the at-risk, the twice/multi exceptional and the autonomous learner. Neither Roep nor Betts and Neihart made the claim that their groupings of gifted types were based on research. However, Neihart and Betts’s twice/multi exceptional and at-risk profiles are of particular interest, as they include characteristics not generally associated with gifted children. For example, they theorised that twice/multi exceptional children may have sloppy handwriting, try to avoid failures, may be stubborn, impatient, disruptive, confused, stressed, frustrated, feel discouraged, rejected, helpless, isolated; and that the at-risk child is angry, depressed, self-isolated, disruptive, and defensive. These negative characteristics may seem quite different to the common perception of children who are gifted. One particular personality theory, the Theory of Positive Disintegration, has been embraced by some scholars who have argued that the differentness of gifted children and their varying characteristics may be explained through this theory (Ackerman, 2009; Silverman, 2009).

Theory of Positive Disintegration (TPD)

Dabrowski’s Theory of Positive Disintegration (1972) can be applied to gifted individuals who, according to the TPD, have increased sensitivity of the neurons, detectable in one, some, or a total of five psychic overexitabilities (OEs) to stimuli. Piechowski (1997a) explains overexcitabilities as modes of experiencing, or channels for colours, textures, insights, visions, and experiences. The psychomotor, sensual, imaginational, intellectual, and emotional OEs, can also be used to predict developmental potential (DP). Each OE has its own particular characteristics, and the Imaginational, Intellectual and Emotional OEs are particularly pertinent to gifted children, as OE characteristics describe a heightened awareness and passion. For example, intellectual OE does not only signify high intellectual ability, but a love of solving problems, and a need to search for truth, and Imaginational OE includes a vivid imagination and inventiveness that can be expressed through thoughts, words or deeds. A strong drive is created through the OEs to achieve individuality through breakdown of psychological structures accompanied by strong anxieties and depression as a person progresses through five levels of development. The TPD involves other elements and as it is a complex theory, space does not allow for further elaboration, however, interested readers are encouraged to read more widely (Ackerman, 2009; Mendaglio, 2008).

OEs as Identifiers

OEs were lauded by some scholars in giftedness as an alternative or additional way to identify both potential and giftedness, and several instruments were designed with this in mind (Falk, Lind, Miller, Piechowski, & Silverman, 1999; Lysy & Piechowsky, 1983; Piechowsky, 1997b). However, they have proven to be less reliable than initially anticipated, with one result able to identify only 70.9 per cent of gifted participants (Ackerman, 1997). Carman (2011) concluded that although a personality-based measure may prove to be useful in identifying gifted children in the future, there is currently no such valid measure.

TPD and Twice-Exceptional Children

Some scholars have expressed concern that Attention Deficit Hyperactivity Disorder (ADHD) and other disorders may be misdiagnosed in gifted children with certain OE characteristics. Amend (2009), for example, raised the risk of OEs being mistaken as
disorders, and misdiagnosed, preventing children's further personal development. Anecdotal evidence indicates that such views, while they have merit, are often taken out of context and used to mythologise a romanticized version of the gifted personality by parents encouraged by less informed and practitioners, who normalise problem behaviours, that may then remain unaddressed. It is also possible that TPD-type therapy may not suit a particular problem, nor prevent further deterioration, a risk that requires the close monitoring of highly skilled practitioners. Antshel (2008), for example, whose research was carried out with the awareness that some scholars believed ADHD should not be diagnosed in gifted children, found instead that ADHD was legitimately diagnosed in children who were gifted, and that their diagnoses had similar educational implications as in children who were not gifted. Therefore, if problems arise that are unrelated to inappropriate educational provisions and TPD-type therapy is not the therapy of choice, then there are other evidence based therapies that can help reframe problems and assist the child to progress (Wellisch, Brown, Taylor, Knight, & Berresford, 2011).

Evidence is consistent that the majority of gifted children are well adjusted (Neihart, Reis, Robinson, & Moon, 2002). So how do the problems of some gifted children arise?

The Highly Sensitive Personality

Belsky and Pleuss (2009) posit that a negative, “difficult child” is conceivably of a genotypic influence, although this does not preclude the acquisition of a highly sensitive nervous system during gestation or experientially (Aron & Aron, 1997; Belsky, 2005). This heightened sensitivity makes these children more reactive, and therefore more susceptible to both positive and negative experiences – a hypothesis that can be likened to Dabrowski’s OEs. For example, Belsky and Pleuss (2009) found that children with difficult temperaments as infants were significantly affected by insensitive parenting and poor quality non-maternal care, and that they were more positively affected by sensitive parenting and high quality caregiving in comparison with children who were not identified as difficult when they were infants. We will examine research findings on some early environmental factors associated with adverse child outcomes, such as insecure attachment and maternal depression. We will then consider vulnerabilities specific to gifted children, and the effects of these factors in observable characteristics.

Attachment Theory and Maternal Depression

Attachment was first noted by Bowlby (1969), who observed that when babies and young children would feel threatened or uncomfortable they sought out their mothers, who would then respond. The term *attachment* refers to this special reciprocal relationship between baby and mother (Prior & Glaser, 2006). Bowlby (1969) theorized that children became either securely or insecurely attached and constructed internal working models or cognitive maps of social interaction based on their experience and responsiveness of their attachment figures. For example, if a mother was too intrusive, the child may copy this behaviour, and may also project this type of behaviour onto others. One study found that 74% of chronically depressed mothers had insecurely attached babies (McMahon, Barnett, Kowalenko, & Tennant, 2006). This is compared with approximately 33% for the general population (Prior & Glaser, 2006). Maternal depression at a key time in the baby's development has been linked to disorders in attachment and less than optimal cognitive development (Cicchetti, Rogosch, & Toth, 1998) and socio-emotional adjustment (Wellisch, Brown, & Knight, 2011). Predictors of child vocabulary, for example, have been associated with the mother's vocabulary (Snow, 1998) and negative effect on caregiving, which can then affect children's language (Stein, Malmberg, Sylva, Barnes, & Leach, 2008). It may, therefore, also affect verbal IQ and social interaction, and may be a key cause of social difficulties experienced by gifted children. This notion appears to be supported by recent findings that depression appeared to be the most influential factor in their children's later problems with peers and at school (Wellisch, Brown, & Knight, 2011). A recent study
(Wellisch, Brown, Taylor, Knight, Berresford, Campbell, et al., 2011) found that maternal depression was also associated with learning difficulties in gifted children in the area of handwriting. Other studies have found that children's handwriting can be an indicator of giftedness, and that the interaction between handwriting and concentration (e.g., attention) can be a significant indicator of underachievement (Stoeger, Ziegler, & Martzog, 2008; Stoeger & Ziegler, 2010). It is therefore conceivable that there is a connection between maternal depression, particularly during the first 12 months (Joseph, 1999), and language development, handwriting, and underachievement.

As has been outlined above, maternal depression at a key time in the life of a developing child may contribute to later learning difficulties and disorders. These may show themselves in learning disorders, other underachievement problems and in the social interactions of twice-exceptional children.

**Effect of Attachment Style on Intelligence**

A theme of two types of giftedness has been noted by several scholars. Basing her review on past research, Winner (2000) concluded that beside for gifted children who did well there was a group gifted in mathematics, visual arts, and music who may have enhanced right-hemisphere brain development. She also cited studies demonstrating that artist had a disproportionate incidence of language-related learning disorders, lacked interest in academic achievement, and were disproportionately diagnosed with manic depression (now known as Bipolar Disorders). Csikszentmihalyi and Csikszentmihalyi (1993) found one gifted type to be highly intelligent, effective and successful, coming from warm, supportive and stimulating families. The other type identified was highly creative (e.g. scientists, artists, musicians), individuals who had in many cases triumphed over early disruptions and traumatic circumstances, indicating that these two gifted types may overlap with secure and insecure attachment styles respectively. For example, insecure attachment and traumatic early experience may lead to permanent effects, with repercussions for some or all areas of development (Perry, Pollard, Blakley, Baker, & Vigilante, 1995). Ainsworth and Wittig (1969) identified two insecure attachment styles: the insecure ambivalent (sometimes also referred to as anxious), and the insecure avoidant style, although there is only one secure attachment style.

**Secure Attachment and Gifted Children**

A recent longitudinal study found that maternal support was strongly predictive of the size of the hippocampus in non-depressed school children (Luby et al., 2012). The hippocampus, an area in the brain related to learning, memory and coping with stress, was almost 10 per cent larger than in other children. Perry & Szalavitz (2006) observed that intelligence may enable and accelerate recovery from poor care taking once the environment improves, and that intelligent children may learn more quickly to associate pleasure with their mothers’ responses, even when pleasurable interaction is in short supply. Intelligence may, therefore, be a protective factor, a suggestion also made by other experts from a variety of backgrounds (Fergusson, Lynskey, & Horwood, 1996; Gunnar, 1998; Johnson & Flake, 2007). If this were the case, we could expect to see more securely attached children in a gifted population than in a general sample. This was, in fact, the conclusion in a study of 65 Dutch middleclass children (Van IJzendoorn & Van Vliet-Visser, 1988). A recent study involving eighty 7–10 year old children found that children with scores >IQ120 on any Wechsler Intelligence Scale for Children (WISC-IV; Wechsler, 2003) index or FSIQ were more likely to be securely attached (Wellisch, Brown, Taylor, Knight, Berresford, Campbell, et al., 2011). Although this difference was not significant, a power analysis indicated the finding would have reached significance with 150 participants.

**Secure Attachment Characteristics**

Although there has been a general conception that gifted children tend to be introverted
(Silverman, 2002; Winner, 2000), it is possible that only children who have been affected by insecure attachment and/or maternal depression may develop this characteristic. For example, a recent qualitative study with 11 mothers (Wellisch, Brown, & Knight, 2011) found that children with no adjustment problems were reported to be extraverts, whereas children who were identified with internalising problems tended to be introverted (see table 1). More research with a larger population is needed to confirm this finding.

Two other important characteristics of both secure attachment and giftedness are curiosity and persistence. Studies have found less curious and exploratory behaviour in humans and animals under adverse and deprived environments (Joseph 1999). Secure attachment calls forth a positive attitude (Greenberg, 1999), which in turn leads to higher levels of engagement and persistence (Blair, 2002).

Persistence is an essential characteristic in the manifestation of potential, and a factor in enduring practice to ensure achievement (Ericsson, Prietula, & Cokely, 2007). A similar characteristic, “task commitment” requires persistence, and is one of three defining identifiers of gifted children, according to Renzulli (2005). The results above, however, indicate that it would be possible to be gifted and at the same time lack in persistence due to early experience, generally seen in children known as gifted underachievers. A classical longitudinal study on gifted children found just two factors separating the most and least successful gifted individuals: Drive to achieve – requiring persistence – and all-round social and emotional adjustment (Terman & Oden, 1959). As we have seen, these are both associated with secure attachment.

Perfectionism is another characteristic often mentioned in relation to gifted children, and Speirs Neumeister and Finch (2006) found two types of perfectionism: adaptive and maladaptive. They found that adaptive perfectionism, involving the commitment to continue perfecting an ability, was associated with secure attachment, whereas maladaptive perfectionism, for example, setting unrealistically high standards was associated with insecure attachment.

In summary, secure attachment via a well-adjusted mother can be seen as natural precursors for giftedness as it promotes language and other aspects of development. Securely attached gifted children are likely to be extraverted, adaptive perfectionist, competent, socially and emotionally well balanced, curious, persistent, self-confident, and positive.

**Insecure Attachment Characteristics**

**Characteristics We Can Expect From an Insecure Anxious Gifted Child.** Anxious insecurely attached babies tend to cry more, and are immediately and intensely distressed when their mothers leave, but are not particularly comforted upon their return (Prior & Glaser, 2006). Insecure anxious children are less forceful, less confident, more withdrawn, more passive and more hesitant in relation to new experience than children who are securely attached (Prior & Glaser, 2006). Their learnt reluctance to attempt new experiences, and the anxiety and tendency to depression brought about by their insecure attachment style may affect both intellectual and all other potential.

Children’s negative traits (Perry & Szalavitz, 2006) are likely to stem from maternal depression and insecure attachment (McMahon et al., 2006). A recent study (Wellisch, Brown, Taylor, Knight, Berresford, Campbell, et al., 2011). found that children whose mothers reported being depressed had higher internalising and total problem scores on the Child Behavior Checklist (Achenbach & Rescorla,1991). Maternal depression has also been associated with poor school performance and underachievement (Leschaid, Chiodo, Whitehead, & Hurley, 2005), subjects often linked with gifted children.

Speirs Neumeister and Finch (2006) reported that maladaptive perfectionism was associated with insecure attachment. Maladaptive perfectionism may show itself as habitual procrastination and frequent destruction of drawings or work due to dissatisfaction with consequent lack of productivity and underachievement.
What We Can Expect From the Insecure Avoidant Gifted Personality. The effects of early and ongoing attachment problems have proven difficult to remedy (even when the environment changes, for example, when the mother’s depression has been addressed), possibly due to the initial malorganisation of neural functions in the developing brain (Davidson, 1994; Joseph, 1999; Perry, 2002). These may be the residual issues that cause the problems in some gifted children.

Babies who are avoidantly insecure have been observed to explore equally well in the mother’s absence or presence, to seek little contact with mothers, and rarely show distress when their mothers leave (Prior & Glaser, 2006). When older, these children are angry, aggressive, more hostile than others, have more antisocial behaviours, more negative feelings, and are more likely to bully other children even as preschoolers. They are usually more demanding and commanding, more likely to have poor peer relationships, and to be depressed (Lyons-Ruth, Easterbrooks, & Cibelli, 1997). Insecurely attached children may also have ongoing problems that include learning disabilities, and psychological and behavioural problems. Motivation is also likely to be affected early in life. For example, when a baby’s needs are rarely met, “learnt helplessness” is the result, with the child eventually giving up, and withdrawing rather than persisting (Seligman, 1990).

Summary of Insecure Characteristics

In summary, insecure anxious attachment may result in the following characteristics: introverted, negative, a tendency to become anxious and depressed, and a reluctant to attempt new experiences. Although the anxiously attached may eventually achieve, both types of insecure attachment can share the characteristics of maladaptive perfectionism and underachievement. Additional characteristics related to insecure avoidant attachment also include hostile, angry, aggressive, demanding and commanding behaviours with antisocial behaviour with poor peer relationships.

Gifted Characteristics

The review of negative characteristics associated with attachment difficulties early in life appears to clarify the reason behind the difficulty in defining, identifying, and grouping gifted children. In order to reconcile these diversities, we need to examine the types of characteristics associated with giftedness regardless of diverse backgrounds or levels of giftedness.

Basic Gifted Characteristics

Frasier and Passow (1994), who were interested in promoting the development of children from diverse backgrounds, identified 10 core gifted characteristics, not all necessarily possessed by each individual. They were: Motivation, intense unusual interest, highly expressive communication skill, effective problem solving ability, excellent memory, inquiry (curiosity), quick grasp or insight, uses logic and reasoning, imagination or creativity, and able to convey and pick up humour. As well as being reliable characteristics for children of diverse backgrounds, they also appear to overlap with a selection of the characteristics identified by parents of highly and profoundly gifted children (Rogers & Silverman, 1997).

In addition to these, high sensitivity (Rogers & Silverman, 1997; Silverman, 1998; 1983) has frequently been linked to giftedness, and ability to read fluently before school age has been identified as a reliable sign of the more highly gifted (Clark 1992; Rogers & Silverman, 1997).

It is important to note here that gifted characteristics are culturally defined, and some characteristics considered to be signs of giftedness in a minority culture may run counter to the dominant culture. For example, a significant characteristic of giftedness amongst Aboriginals in Western Australia is one-ness, or belonging with the mob (Cooper, 2005),
and the key for giftedness according to Maori values is the possession of exceptional skills in helping others (Bevan-Brown, 2005). Neither gifts would elicit competitiveness or a penchant for achievement in children from these cultures, although competitiveness and achievement are valued in Western culture, and may more easily catch a teacher's attention. Teachers of a diverse group of children may therefore fail to look for or identify giftedness in some children who for cultural reasons are unwilling to demonstrate their abilities.

**Current Study and Socio-Emotional Characteristics**

The research focus of our current study (Wellisch, Brown, & Knight, 2011) was any parenting effect on children's socio-emotional development, particularly the effect of maternal depression. Results indicate that gifted children may be vulnerable to being misunderstood due to their differentness. We found that gifted children were more likely to have clinical or borderline internalizing problems if their mothers had been depressed, and if they had been serially misunderstood in a variety of primary social contexts – at home, by peers, and in those educational settings that failed to provide appropriately for their advanced and different educational needs. However, these factors did not individually cause serious adjustment problems, and children who experienced isolated contexts of being misunderstood did not have adverse outcomes. There appeared to be an additive pattern of being misunderstood at home, rejected and bullied by peers of a different maturity and ability, and ongoing educational indifference and neglect that together contributed to some children's chronic internalizing and externalizing problems.

**Differences in Basic Gifted Characteristics May Relate to Problems**

As has been demonstrated, the 12 identified gifted characteristics may not be sufficiently reliable to correctly screen gifted children with socio-emotional and other problems. These children may lack motivation, persistence, and sufficient attention for on-going interests in particular skills or topics, their language and communication skills may not be quite so advanced if their mothers have been depressed and withdrawn, and their memory may not be as sharp as could have been otherwise expected due to loss of confidence, when affected by anxiety or depression. In fact, they may only show a few of the gifted characteristics, and may, instead, exhibit some other characteristics, as already mentioned. This can be illustrated with data from our qualitative study, partially reported here. We were able to access quantitative data on the participants, collected when they participated in a previous larger study. Permission was obtained by the first author to search the interview transcripts, and the new data on comments mothers made about their children's characteristics is reported here. Table 1 sets out the pattern of 17 characteristics as reported for five gifted children identified with borderline or clinical internalising problems, and for the remaining six children who were reported to be well adjusted.

Although the population for this research was small and care should be taken in generalising the findings, table 1 indicates that a gifted child with socio-emotional problems may present as a precocious developer with possible learning difficulties who is introverted, sensitive, highly creative, perfectionist, less likely to be sporty in the case of boys, more likely to have a keen sense of humour, a child who demonstrates occasional and inconsistent gifted characteristics.

Four of the five children with internalising scores had higher Perceptual Reasoning (PR) scores than their Verbal Comprehension (VC) sub-test scores on the WISC-IV. Silverman (2002) noted similar IQ discrepancies between the verbal and performance scores in the IQ tests of students she identified with ‘visual-spatial’ orientation, who thought in pictures and had difficulty in demonstrating their giftedness through achievement.
Table 1. Characteristics of Gifted Children With and Without Internalising Problems

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Internalising children (^b) ((n=5))</th>
<th>Non-internalising children ((n=6))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easily Frustrated</td>
<td>Alex, Tom, Skye</td>
<td>Robert, Kate</td>
</tr>
<tr>
<td>Perfectionist</td>
<td>Alex, Tom, Skye</td>
<td>Robert</td>
</tr>
<tr>
<td>Intense</td>
<td>N/A</td>
<td>Robert, Natalie</td>
</tr>
<tr>
<td>Wilfulness</td>
<td>Aaron</td>
<td>Steven, Kate, Jack, Natalie</td>
</tr>
<tr>
<td>Testing boundaries</td>
<td>Peter</td>
<td>Kate, Jack, Natalie</td>
</tr>
<tr>
<td>Sexually atypical behaviour</td>
<td>Alex, Tom</td>
<td>Steven, Kate, Robert</td>
</tr>
<tr>
<td>Persistent</td>
<td>Peter</td>
<td>N/A</td>
</tr>
<tr>
<td>GLD</td>
<td>Tom, Aaron, Skye</td>
<td>Steven</td>
</tr>
<tr>
<td>Great sense of humour</td>
<td>Tom, Aaron, Peter, Skye</td>
<td>N/A</td>
</tr>
<tr>
<td>Introvert</td>
<td>Alex, Tom, Aaron</td>
<td>Jack</td>
</tr>
<tr>
<td>Empathetic</td>
<td>Peter, Skye</td>
<td>Kate, Natalie</td>
</tr>
<tr>
<td>Creative</td>
<td>Peter, Aaron, Skye</td>
<td>Steven, Robert</td>
</tr>
<tr>
<td>Sensitive</td>
<td>Tom, Peter, Skye</td>
<td>Natalie</td>
</tr>
<tr>
<td>Extravert</td>
<td>Peter</td>
<td>Mark, Steven, Kate, Robert, Natalie</td>
</tr>
<tr>
<td>Precocious developer</td>
<td>Tom, Peter, Skye</td>
<td>Natalie</td>
</tr>
<tr>
<td>Great communicator</td>
<td>Peter, Skye</td>
<td>Mark, Steven, Kate, Natalie</td>
</tr>
<tr>
<td>Not sporty (boys)</td>
<td>Alex, Tom, Peter</td>
<td>Robert</td>
</tr>
</tbody>
</table>

\(^a\) Children with higher Perceptual Reasoning (PR) scores in comparison to their Verbal Comprehension (VC) scores on the WISC-IV were Jack, Alex, Tom, Aaron, Peter

\(^b\) Real names are not used

**The Gifted Spectrum – A Conclusion**

We have attempted to demonstrate in this article that children who are gifted may be difficult to define and identify without a clear concept of the complex factors and contexts that may be involved in their early development and their resulting characteristics and personalities. There appears to be some agreement about two specific expressions of giftedness (Csikszentmihaly & Csikszentmihaly, 1993; Winner, 2000) and as has been demonstrated, they may be accompanied by any number of diverse characteristics with a multitude of possible combinations. The first is the positive, well adjusted, resilient, intellectually gifted achiever, and the second may be anxious, introverted, creative, possibly mathematically or scientifically gifted, and susceptible to both positive and negative experiences that appear to determine level of adjustment and achievement (Belsky, 2005; Dabrowski, 1972; Winner, 2000).

A spectrum of gifted characteristics is proposed, based on current and relevant research (Appendix; DSM-5; American Psychiatric Association, 2013). The Spectrum of Characteristics can be used as an initial screening tool to aid early identification of children who may be gifted, although care should be taken to ensure it is not used for diagnosis. The Spectrum of Characteristics provides an overview of disorders, their tentative predicted effects on observable gifted characteristics based on the literature and authors’ observations, and possible attachment styles. The tool should be used with caution, as children may have concurrent disorders, which may then alter the observable characteristics of giftedness. It is our hope that this screening tool will more precisely help identify children’s abilities and needs within the spectrum of giftedness, so that they can be offered the adequate and appropriate educational and therapeutic support that may prevent underachievement and encourage them to blossom.
References


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**The Authors**

Mimi Wellisch is a registered psychologist who is passionate about providing opportunities for gifted children. She also has a Master of Early Childhood from Macquarie University, where she is completing a PhD thesis on the connection between attachment and IQ. Mimi is the author of a number of books and peer reviewed and other articles, and has presented papers and workshops at many local and international conferences. She has also held the positions of President, Vice President, and Treasurer of the NSW Association for Gifted and Talented Children.

Dr. Jac Brown is a Senior Lecturer teaching in the area of clinical psychology at Macquarie University.
## Appendix

<table>
<thead>
<tr>
<th>DSM-5 Disorders</th>
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<th>Brief Summary of Characteristics Described in DSM-5</th>
<th>Observable Gifted Characteristics*</th>
<th>Attachment Characteristics*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIL</td>
<td>NIL</td>
<td>NIL</td>
<td>Motivation – Evidence of desire to learn</td>
<td>Secure Attachment: <em>extraverted</em>, competent, socially and emotionally well balanced, curious, persistent, self-confident, and positive.</td>
</tr>
</tbody>
</table>

### Attention-Deficit/Hyperactivity Disorder (ADHD)

Symptoms present for at least 6 months prior to age 12 years. More common if also found in first degree biological relatives. Significantly impaired social or academic functioning. Co-occurs in 50% of cases with Oppositional Defiant Disorder, with Conduct Disorder in 25% of cases, and often with Specific Learning Disorder. Peers likely to reject and tease child with ADHD.

**Inattentive:** Difficulty in sustaining attention, easily distracted, often does not finish work, disorganised, does not seem to listen, avoids long-lasting activities (e.g., homework), forgetful, loses things.

**Hyperactive and Impulsive:** Fidgets, taps hands or feet, frequently leaves seat, inappropriate running and climbing, blurs out answers or interrupts, inability to play quietly, often on the go, “driven like a motor”, intrudes on others, finds it difficult to wait for turn.

**Motivation** – Enthusiasm to learn may be sporadic, may not finish work

**Interests**, intense, sometimes unusual

**Communication skills** – Highly expressive with words, numbers or symbols

**Problem solving** – Often inventive strategies for recognizing and solving problems

**Memory** – Not applicable in practical situations, forgetful

**Reasoning** – Experiments, explores but may take risks, and may ask questions but not wait for answers

**Imagination, Creativity** – Produces many ideas; highly original

**Humour** – Conveys and picks up humour well

**Sensitive** – May be intolerant to certain smells, textures, sounds

### NIL

NIL

NIL
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<tbody>
<tr>
<td><strong>Specific Learning Disorder (SLD)</strong></td>
<td>Neurodevelopmental disorder with biological origin as basis for abnormalities at cognitive level. Persistent difficulty learning key-stone academic skills. Onset during years of formal schooling observed for at least 6 months. SLD, including Dyslexia, more common in first degree relatives. Learns to compensate. Often associated with ADHD, autism spectrum disorders, anxiety, depressive and bipolar disorders.</td>
<td>May have had delay in language or motor skills when younger, or was inattentive at preschool. May have oppositional behaviour and reluctance to engage in learning. Non-responsive to intervention, although may improve with evidence-based interventions.</td>
<td>Motivation – Desire to learn may be diminished due to low self-esteem Interests, intense, sometimes unusual Communication skills – highly expressive with words, numbers or symbols, although may find it difficult to express in writing, and not in the area of LD Problem solving – not in the area of LD and may have lost interest due to low self-esteem on account of LD Memory – not in area of LD Inquiry – enthusiasm may have been affected by LD and loss of confidence Reasoning – may have been affected by LD and loss of confidence Imagination, Creativity – Produces many ideas; highly original Humour – conveys and picks up humour well Sensitive – may be intolerant to certain smells, textures, sounds</td>
<td>Insecure Anxious Attachment: introverted, anxious, less forceful, less confident, more withdrawn, more passive and more resistant, more likely to be diagnosed with internalizing disorders such as anxiety and depression.</td>
</tr>
<tr>
<td><strong>Autism Spectrum Disorder Level 1 – ‘requiring support’</strong></td>
<td>Deficits in social communication. Typically recognised between 12 and 24 months of age. Functional language by 5 years. Four times more frequent in boys and between 37% and 90% heritability. Others in the family may be diagnosed or have similar symptoms. Interventions or compensations improve symptoms, but disorder will continue to cause impairment in social and, occupational areas of functioning. Seventy per cent have co-occurring disorder, for example as ADHD. Prone to anxiety and depression.</td>
<td>Delayed language development. Apparent lack of social interest. Appears deaf, but this is usually ruled out. Odd and repetitive behaviours. Socially naïve and vulnerable. Inflexible, has difficulty switching between activities. Has non-verbal deficits and may speak in a stilted and overly literal language, with one-sided conversation lacking in reciprocity. When young, shows little or no initiation of social interaction, no sharing of emotions, and reduced or no imitation of others.</td>
<td>Motivation - Evidence of desire to learn Interests, intense, sometimes unusual Communication skills – advanced verbal ability, may speak with ‘posh’ accent, tending to deliver verbose monologues about topic of intense interest Problem Solving Ability – effective, often inventive, strategies for recognising and solving problems Memory – large storehouse of information, particularly on subject of intense interest Inquiry – questions, but does not listen and tends to ask same question, again and again; experiments, explores Reasoning – logical approaches to figuring out solutions Sensitive – tendency to be hyper-sensitive to certain sounds, textures, and other sensory events Able to read fluently before school (if highly or profoundly gifted) May be perfectionist (most likely the maladaptive type, depends on current state of anxiety)</td>
<td>N/A</td>
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<td>Disruptive Mood Dysregulation Disorder</td>
<td>Onset between 6 to 10 years. Children predominantly male. Symptoms present for at least 12 months. Cannot co-occur with Oppositional Defiant Disorder (ODD) or bipolar disorder. Marked disruption in child's family relationships and school performance, has trouble initiating and sustaining friendships. High rate of co-occurrence with many other disorders, including ADHD and Conduct Disorder.</td>
<td>Chronic and severe irritability, recurrent temper outbursts, verbal rages, physical aggression toward people or property grossly out of proportion to situation or provocation, and inconsistent with developmental level. Persistently angry most of the day.</td>
<td>May interfere with observable gifted characteristics. Between angry outbursts there may be glimpses of gifted characteristics. Child may also be unlikely to finish work, performing below ability in tests and assessments.</td>
<td>Insecure Avoidant Attachment: hostile, angry, aggressive, antisocial behaviours, negative feelings, and likely to scapegoat and victimise other children, demanding and commanding, more likely to have poor peer relationships and suffer from depression.</td>
</tr>
<tr>
<td>Post-traumatic Stress Disorder (PTSD)</td>
<td>Can occur at any age including first year of life. Symptoms usually begin within 3 months of trauma, although this may be delayed significantly. Recurrent distressing dreams, intrusive symptoms and memories, avoidance of activities or places. Can result in impaired functioning. Eighty per cent more likely than others to be diagnosed with at least one other mental disorder.</td>
<td>Self-blame, negative beliefs about self (“I am bad”), irritable, angry, aggressive, hyper-vigilant, exaggerated startle response, feeling detached from body and from others, prone to dissociation, difficulty sleeping. May re-enact scene of trauma repetitively through play.</td>
<td>May interfere with observable gifted characteristics. During periods of fatigue, anxiety, and depression there may be only glimpses of gifted characteristics as a result of lack of motivation. Child may also be unlikely to finish work, performing below ability in tests and assessments. If this behaviour is unusual and has a sudden onset, an appointment should be made with a psychologist as soon as possible.</td>
<td>Insecure Avoidant Attachment: hostile, angry, aggressive, antisocial behaviours, negative feelings, and likely to scapegoat and victimise other children, demanding and commanding, more likely to have poor peer relationships and suffer from depression.</td>
</tr>
<tr>
<td>Conduct Disorder (CD)</td>
<td>Can be mild, moderate and severe. Onset before age 10 years, with behaviours present for the past 12 months. Typically male, physically aggressive to others, disturbed peer relationships, may have had Oppositional Defiant Disorder during early childhood. Often with co-occurring ADHD. More likely to develop Antisocial Personality Disorder when older.</td>
<td>Bullies others, fights, uses weapons, is cruel to animals or others, steals, sets fires, deceitful, skips school, can lack remorse and empathy.</td>
<td>Communication skills – highly expressive with words, numbers or symbols Problem solving – although not usually used for positive outcomes Imagination, Creativity – Produces many ideas; highly original, although may be used to lie to others Humour – conveys and picks up humour well, although may see humour in misfortune of others Sensitive – may be intolerant to certain smells, textures, sounds May be a perfectionist (maladaptive type, e.g. re-does and rips up work, procrastinates)</td>
<td>Insecure Avoidant Attachment: hostile, angry, aggressive, antisocial behaviours, negative feelings, and likely to scapegoat and victimise other children, demanding and commanding, more likely to have poor peer relationships and suffer from depression.</td>
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<tr>
<td><strong>Oppositional Defiant Disorder (ODD)</strong></td>
<td>Often results in significant emotional, social, and academic impairments. Commences in early childhood and if younger than 5 years, behaviour occurs on most days for at least 6 months, if older, behaviour at least weekly for diagnosis. Can occur in just one setting (e.g. home). More common with harsh, inconsistent or neglectful parenting. Can co-occur with Conduct Disorder, ADHD. As adults, at risk of antisocial behaviour, impulse-control problems, substance abuse, anxiety, and depression.</td>
<td>Frequent conflicts with parents, teachers, peers. Argumentative, loses temper, defiant or refuses to comply, annoys others, blames others for behaviour, annoyed by others, angry, spiteful, and resentful.</td>
<td>Communication skills – highly expressive with words, numbers or symbols Problem solving – Effective, often inventive, strategies for recognizing and solving problems. although not usually used for positive outcomes Imagination, Creativity – Produces many ideas; highly original, although may be used to lie to others Humor – conveys and picks up humor well, although may see humour in misfortune of others Sensitive – may be intolerant to certain smells, textures, sounds May be a perfectionist (maladaptive type, e.g. re-does and rips up work, procrastinates)</td>
<td>(continued from above) ... likely to have poor peer relationships and suffer from depression.</td>
</tr>
<tr>
<td><strong>Generalized Anxiety Disorder (GAD)</strong></td>
<td>Excessive anxiety and worry compared to actual likelihood or impact of event. Twice as likely in females. Diagnosed if symptoms persist for at least 6 months. Likely to also meet criteria for other anxiety and unipolar depressive disorders, and can be over-diagnosed in children instead of other anxiety disorders. Can co-occur with panic attacks.</td>
<td>Children tend to be overly conforming, perfectionists, unsure of themselves, worry excessively about their competence or quality of performance. Worry may shift from one concern to another. Anxiety is distressing. May be keyed up, restless, have muscle tension, be on edge, easily fatigued, have difficulty concentrating, mind going blank, be irritable, have disturbed sleep. May worry about catastrophic events like earthquakes or nuclear war.</td>
<td>Presence of the gifted characteristics of Motivation, Interest and Memory depends on level of anxiety, may show only glimpses, and these characteristics may be unstable due to anxiety. Communication skills – highly expressive with words, numbers or symbols, although may be shy Problem Solving Ability – effective, often inventive, strategies for recognising and solving problems Inquiry – questions, although can be tempered by shyness and less likely to experiment and explore Reasoning – logical approaches to figuring out solutions Imagination, Creativity – Produces many ideas; highly original Humor – conveys and picks up humour well Perfectionist (maladaptive type e.g., re-does and rips up work, procrastinates)</td>
<td>Insecure Anxious Attachment: introverted, anxious, less forceful, less confident, more withdrawn, more passive and more hesitant are more likely to be diagnosed with internalizing disorders such as anxiety and depression.</td>
</tr>
<tr>
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<tr>
<td>Separation Anxiety Disorder</td>
<td>Clinically significant distress or impairment in social or other important areas of functioning. Early onset at preschool age or older. For diagnosis symptoms persist for at least 4 weeks in children. Equally common in males and females. In children highly co-occurring with General Anxiety Disorder (GAD) and specific phobia.</td>
<td>Excessive distress when separating from home or attachment figure, worry about losing them or harm coming to self or attachment figures (e.g. mother), and therefore reluctant or refuses to go to school or elsewhere, or to stay with others, or be alone, or to sleep without proximity to attachment figures. Nightmares about separation, headaches, stomach aches, nausea or vomiting when separated or when anticipating separation. Clinging behaviour, and shadowing of attachment figure.</td>
<td>Presence of the gifted characteristics of Motivation, Interest and Memory depends on level of anxiety, may show only glimpses, and these characteristics may be unstable due to anxiety. Communication skills – highly expressive with words, numbers or symbols, although may be shy Problem Solving Ability – effective, often inventive, strategies for recognising and solving problems Inquiry – questions, although can be tempered by shyness and less likely to experiment and explore Reasoning – logical approaches to figuring out solutions Imagination, Creativity – Produces many ideas; highly original Humour – conveys and picks up humour well May be a perfectionist (whether adaptive or maladaptive type depends of severity of anxiety)</td>
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<tr>
<td>Obsessive-Compulsive Disorder (OCD)</td>
<td>More common in males during childhood and in females when older. Nearly 25% of males diagnosed before 10 years of age. Marked by dysfunctional beliefs, may not recognise obsession as excessive or unreasonable. If untreated, can be lifelong, with 40% in remission as adults. Often co-occurs with anxiety or depressive disorders. Interferes with routine, social activities, and relationships.</td>
<td>Reduced quality of life and high levels of social and occupational impairment, (e.g. avoidance of places, doctors or excessive hand washing in fear of contamination and high reliance on others). Repetitive rituals and compulsions are lengthy (e.g., more than 1 hour per day) and typically performed in response to obsessions (hand washing, ordering, counting, checking, hoarding) to prevent (unrealistic) dreaded event or situation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Depressive Disorder</td>
<td>At any age, change in behaviour over a 2-week period on most days marked by five or more of these symptoms: Depressed mood, diminished interest or pleasure in most activities, decrease or increase in appetite, insomnia or sleeping much more, physically agitated or much less active, fatigue and lack of energy, feeling worthless or inappropriately guilty, difficulty concentrating, recurrent thoughts of death.</td>
<td>Irritable, angry, blaming, frustrated over minor matters, feels sad, discouraged, hopeless, has difficulty making decisions, can have bodily aches and pains rather than showing or feeling sadness, slow in speech, thinking and bodily movements, avoids activity previously enjoyed, socially withdrawn.</td>
<td>During periods of depression child may show only glimpses of gifted characteristics as a result of lack of motivation, and is also unlikely to finish work, performing below ability in tests and assessments. If this behaviour is unusual for the child, an appointment should be made as soon as possible with a psychologist.</td>
<td></td>
</tr>
</tbody>
</table>

**Attachment Characteristics***

- Insecure Anxious Attachment: introverted, anxious, less forceful, less confident, more withdrawn, more passive and more resistant
- More likely to be diagnosed with internalizing disorders such as anxiety and depression.

*NOTE: Author's own tentative predictions based on observations and reading of the literature.*
Examining Mechanisms That Contribute to Relative Age Effects in Pre-Pubescent Female Ice Hockey Players

David J. Hancock\(^1\), Kelsey Seal\(^1\), Bradley W. Young\(^1\), Patricia L. Weir\(^2\) and Diane M. Ste-Marie\(^1\)

Abstract: Relative age effects (RAEs) in sport often exist when children are grouped into annual age-bands (Barnsley & Thompson, 1988). Recent female studies show different RAE patterns than male sports (Delorme et al., 2010; Weir et al., 2010). Thus, investigations into female RAEs that explain, rather than replicate, RAEs are warranted. One mechanism that might explain RAEs is physical maturity (Musch & Grondin, 2001). Our purpose was to examine if RAEs were tempered in a pre-pubescent sample (4 to 12 years) where physical maturity differences attributed to puberty are lessened. We used multiple chi-squares to analyze registration data for 39,204 female youth ice hockey players and found RAEs with the highest over-representations in the second quartile. We offer explanations for the results and for why physical maturity differences might not temper RAEs.

Keywords: birth rate, birth date distribution, annual age bands, team sport, depth of competition

In an attempt to provide equitable opportunities in youth sport, governing bodies often categorize athletes into annual age-bands. The logic is that this will limit growth and maturational disparities amongst participants within the age-bands. Despite this, chronological age differences exist between “relatively-older” athletes born shortly after the selection cut-off date (e.g., a January birthdate in a competitive age-band spanning January 1\(^{st}\) to December 31\(^{st}\)) and “relatively-younger” athletes born later in the same selection year. A fair amount of evidence now shows that relatively older athletes are over-represented on youth sport teams, resulting in participation and performance advantages over their younger peers (Cobley, Baker, Wattie, & McKenna, 2009); a finding referred to as the relative age effect (Musch & Grondin, 2001; Wattie, Cobley, & Baker, 2008). For example, relative age effects have been shown throughout male team sports including rugby (Till, Cobley, O’Hara, Chapman, & Cooke, 2010; Till, Cobley, Wattie et al., 2010), baseball (Côté, MacDonald, Baker, & Abernethy, 2006; Thompson, Barnsley, & Stebelsky, 1991), soccer (Barnsley, Thompson, & Legault, 1992; Helsen, Starkes, & Van Winckel, 1998; Hirose, 2009), handball (Schorer, Baker, Büsch, Wilhelm, & Pabst, 2009; Schorer, Cobley, Büsch, Bräutigam, & Baker, 2009), and ice hockey (Barnsley & Thompson, 1988; Sherar, Baxter-Jones, Faulkner, & Russell, 2007; Wattie, Baker, Cobley, & Montelpare, 2007), which is the focus in the present study. Given its pervasive nature, sport scientists must make a conscious effort to extend beyond descriptive studies of relative age effects, and attempt to identify and explain mechanisms that contribute to relative age effects. This will allow sport policy makers to determine if, and how, to manage relative age effects.

Despite the breadth of literature in male sports, relative age effect studies conducted with female samples, especially those which attempt to explain relative age mechanisms, have been notably absent. Cobley and colleagues (2009) noted that only 2% of relative age effect research has included female samples. Both Musch and Grondin (2001) and Wattie

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and colleagues (2008) have advocated for more research on female relative age effects in order to extend our understanding of the phenomenon. To address this, Weir, Smith, Paterson, and Horton (2010) examined relative age effects in post-pubescent (average age of 27 years) female ice hockey players in Canada. While they noted a trend similar to that of male ice hockey players, with athletes born in the first and second quartiles of the selection year being over-represented compared to athletes born in the third and fourth quartiles, a notable difference was that athletes born in the second quartile of the selection year were the most over-represented. In male ice hockey, normally the first quartile is most over-represented, with a gradual decrease in presentation across the quartiles (Addona & Yates, 2010; Baker, Cobley, Montelpare, Wattie, & Faught, 2010; Nolan & Howell, 2010; see Hancock, Young, & Ste-Marie, 2011 for an exception), which would be expected if one reasons that relatively older athletes are likely to benefit from greater physical maturity, leading to better physical performance. Similar to Weir and colleagues, researchers have also noted this second quartile trend in female soccer, with the anomaly being attributed to a lack of competition amongst females for spots on a team compared to male sports (Baker, Schorer, Cobley, Bräutigam, & Büsch, 2009; Delorme, Boiché, & Raspaud, 2010; Weir et al., 2010).

Relative age effects are expected for popular sports that have the most participants in a given region, but are not expected for unpopular sports (Musch & Grondin, 2001). For example, Grondin, Deshaies, and Nault (1984) noted relative age effects in Canadian ice hockey, an extremely popular sport, but not in Canadian volleyball. It is essential that research on female relative age effects take sport popularity into consideration; thus, we drew our sample from Canada, a country with a strong female ice hockey program and many registrants. According to the International Ice Hockey Federation (IIHF, 2012), Canada has more female registrants (85,624) than the United States, Finland, and Sweden combined (69,731), which are the most popular countries for female ice hockey after Canada. Furthermore, one province in Canada (Ontario) has seen rapid growth in female ice hockey popularity (OWHA, 2010). The number of female registrants in Ontario ice hockey quadrupled from 1990 (n = 5000) to 2000 (n = 20,000). In 2010, the number of female registrants was approximately 38,000, making up nearly half of the female ice hockey players in Canada. Based on these statistics, examining female RAE effects within the sport of hockey in Ontario ensures our study adhered to principles of sport popularity, thus minimizing this as a possible confounding variable for our results.

One possible mechanism contributing to relative age effects is physical maturity. Musch and Grondin (2001) suggested that relative age effects are due to growth and maturational advancement that leads to advantages (i.e., increased height, weight, coordination, and strength) for relatively older athletes. Several authors (Sherar et al., 2007; Till, Cobley, O’Hara et al., 2010; Till, Cobley, Wattie et al., 2010) have documented these differences between relatively older and younger athletes. Though growth and maturational differences do exist pre-puberty, they are not likely as exaggerated (Malina, Bouchard, Bar-Or, 2004) as that within pubertal and post-pubertal age frames, which might minimize relative age effects in younger samples. Indeed, Baxter-Jones (1995) noted that sexual maturity associated with puberty often accelerates performance advantages attributed to growth and maturational differences. Therefore, we focused on ice hockey players who had not yet reached puberty in order to investigate if relative age effects would be tempered in a pre-pubertal sample. Clearly growth and maturational differences can exist within a one-year cohort of pre-pubescent athletes, but targeting pre-pubescent children who had not reached peak height or peak weight velocity (Haywood & Getchell, 2009), should still minimize such differences. In doing so, we attempted to make a more informed conclusion regarding the role that physical maturity has on relative age effects.

Thus, the purpose of our study was to determine if relative age effects existed for female ice hockey players when physical maturation differences could be considered more limited (i.e., a sample of pre-pubescent females). If previous researchers’ suppositions about physical maturity and relative age effects are correct (Musch & Grondin, 2001; Till,
Cobley, O’Hara et al., 2010), then limiting our sample to pre-pubescent athletes should temper relative age effects.

Traditional relative age effects show the strongest over-representations in the first quartile, followed by the second quartile. Though a few recent studies have reported higher over-representations of female athletes born in the second quartile compared to those in the first quartile (Baker et al., 2009; Delorme et al., 2010; Weir et al., 2010) those authors suggested that this anomaly was due to the fact that female sports did not have the same depth of competition as in males sports. Given the popularity of ice hockey and depth of competition in our sample, however, we hypothesized that relative age effects would be found in each age division, and that inter-quartile patterns would mimic results from male sports (i.e., strongest over-representation of athletes found in the first quartile). Additionally, we expected the strength of our relative age effects to be weaker than that found in other samples, due to the fact that we limited our sample to pre-pubescent females.

Method

Participants

Canadian female ice hockey players begin in the developmental system as early as age 4, and can continue in that system until age 21. Our targeted sample comprised female players 4 to 12 years who likely had not reached puberty, which occurs typically between the ages of 12 and 14 years (Haywood & Getchell, 2009). We examined 39,204 female ice hockey players from the province of Ontario who were all registered in the Ontario Hockey Federation during the 2007 and 2008 seasons. Participants competed in one of five age divisions, which are two-year age brackets (with the exception of Pre-Novice, which is three years). For each age division, we sub-divided participants into minor (first-year) and major (subsequent year/s) classifications.

Data Collection

The Ontario Hockey Federation maintains a database for all players registered in their system. We were provided with access to this anonymous database and given consent from the federation to analyze participant data. The database included players’ birth dates, sex, and age division. We extracted all female players who were registered during the 2007 and 2008 seasons. To ensure accuracy, all entries with missing information were deleted. Birth dates were then transformed into quartiles (Q), which corresponded with the Hockey Canada and Ontario Hockey Federation selection year, which starts January 1: Q1 = January 1 to March 31; Q2 = April 1 to June 30; Q3 = July 1 to September 30; Q4 = October 1 to December 31.

Data Analysis

Data were inputted and tested using SPSS 20. Chi-square goodness of fit tests were conducted to examine if the observed frequency in each birth quartile differed from the expected frequency of 25% in each of the respective quartiles. To determine statistical significance, the critical $p$-value was set at $p < .01$. Effect sizes ($w$) were also calculated ($w = \sqrt{\chi^2/n}$) to determine the strength and meaningfulness of results. Cohen (1988) suggested that $w$ values of 0.1, 0.3, and 0.5 correspond to small, medium, and large effect sizes, respectively. One limitation of most relative age effect research using chi-square tests is that post-hoc tests are not conducted to determine where significant deviations from the expected distribution occur. We believe that reporting raw percentages is not sufficient to determine precise differences, especially if investigators are testing over- or under-representation by quartiles instead of half-years. Consequently, we implemented standardized residuals as post-hoc tests when significant chi-square results existed, which is considered a robust approach (Garson, 2010; Hancock et al., 2011).
Standardized residuals are similar to z-scores (where the mean equals 0.00 and each standard deviation is +/- 1.00) that denote deviations from an anticipated distribution (Garson, 2010). For this study, a positive standardized residual (SR) was indicative of over-represented participation in a birth quartile compared with the anticipated distribution of 25% in that quartile. A negative standardized residual was indicative of under-represented participation in a birth quartile. At a minimum, standardized residuals were noteworthy when confidence intervals were equivalent to $p < .01$ (standardized residuals = +/- 2.58).

**Results**

Before examining each age division, we conducted a chi-square test on the entire sample of female ice hockey players ranging in age from 4 to 12 years. Results showed that the observed distribution (see table 1) significantly differed from the expected distribution, $\chi^2(3, 39,204) = 686.70, p < .001, w = 0.13$. Post-hoc tests for the entire sample showed that Q2 ($SR = 14.78$) was significantly over-represented, as was Q1 ($SR = 6.68$), though to a lesser extent, whereas Q4 ($SR = -20.57$) was significantly under-represented. No significant deviation existed for Q3.

Next, we determined whether inter-quartile differences existed for each of the age divisions by conducting chi-square tests and subsequent post-hoc tests by quartile, within each one-year age group (see table 1). First, chi-square results and significance values for each age group reflected those found for the entire sample (i.e., $p < .001$). For effect sizes, there was some variability when following successive age divisions, but effects were consistently small, ranging from $w = 0.11$ to 0.22. Post-hoc tests also revealed consistent patterns in each quartile except in Q1. The representation of athletes born in Q1 did not deviate from the expected distribution at 4 to 6 years ($SR = 2.56, 1.33$). From 7 to 9 years, athletes were significantly over-represented in Q1 ($SR = 4.38, 4.13, 3.73$), but from 10 to 12 years, Q1 athletes did not significantly differ from the expected distribution ($SR = 1.09, 1.77, and 1.42$). Conversely and notably, Q2 athletes were over-represented in all age divisions (all $SR > 2.58$). Furthermore, for all but the minor Novice division (8 years), the Q2 $SR$ value was stronger than the Q1 $SR$ value. The representation of athletes born in Q3

Table 1. Chi-Square Results, Effect Sizes, Quartile Percentages, and Standardized Residuals for Female Ice Hockey Players Registered in the Ontario Hockey Federation During the 2007 and 2008 Seasons

<table>
<thead>
<tr>
<th>Division</th>
<th>Age</th>
<th>n</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>w</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>SRQ1</th>
<th>SRQ2</th>
<th>SRQ3</th>
<th>SRQ4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All Divisions</strong></td>
<td>4-12</td>
<td>39,204</td>
<td>686.70</td>
<td>&lt;.001</td>
<td>0.13</td>
<td>26.69</td>
<td>28.73</td>
<td>24.78</td>
<td>19.81</td>
<td>6.68*</td>
<td>14.78*</td>
<td>-0.89</td>
<td>-20.57*</td>
</tr>
<tr>
<td><strong>Minor Pre-Novice</strong></td>
<td>4</td>
<td>719</td>
<td>33.65</td>
<td>&lt;.001</td>
<td>0.22</td>
<td>29.76</td>
<td>30.60</td>
<td>21.97</td>
<td>17.66</td>
<td>2.56</td>
<td>3.01*</td>
<td>-1.63</td>
<td>-3.94*</td>
</tr>
<tr>
<td><strong>Major Pre-Novice</strong></td>
<td>5, 6</td>
<td>3879</td>
<td>46.35</td>
<td>&lt;.001</td>
<td>0.11</td>
<td>26.06</td>
<td>27.82</td>
<td>25.57</td>
<td>20.55</td>
<td>1.33</td>
<td>3.51*</td>
<td>0.72</td>
<td>-5.55*</td>
</tr>
<tr>
<td><strong>Minor Novice</strong></td>
<td>7</td>
<td>3279</td>
<td>100.75</td>
<td>&lt;.001</td>
<td>0.18</td>
<td>28.82</td>
<td>28.97</td>
<td>23.94</td>
<td>18.27</td>
<td>4.38*</td>
<td>4.55*</td>
<td>-1.22</td>
<td>-7.71*</td>
</tr>
<tr>
<td><strong>Major Novice</strong></td>
<td>8</td>
<td>4525</td>
<td>92.93</td>
<td>&lt;.001</td>
<td>0.14</td>
<td>28.07</td>
<td>28.00</td>
<td>24.66</td>
<td>19.27</td>
<td>4.13*</td>
<td>4.04*</td>
<td>-0.45</td>
<td>-7.71*</td>
</tr>
<tr>
<td><strong>Minor Atom</strong></td>
<td>9</td>
<td>5807</td>
<td>128.27</td>
<td>&lt;.001</td>
<td>0.15</td>
<td>27.45</td>
<td>28.57</td>
<td>25.02</td>
<td>18.96</td>
<td>3.73*</td>
<td>5.44*</td>
<td>0.03</td>
<td>-9.21*</td>
</tr>
<tr>
<td><strong>Major Atom</strong></td>
<td>10</td>
<td>6536</td>
<td>116.94</td>
<td>&lt;.001</td>
<td>0.13</td>
<td>25.67</td>
<td>29.47</td>
<td>24.79</td>
<td>20.07</td>
<td>1.09</td>
<td>7.22*</td>
<td>-0.35</td>
<td>-7.97*</td>
</tr>
<tr>
<td><strong>Minor Peeewee</strong></td>
<td>11</td>
<td>7279</td>
<td>111.45</td>
<td>&lt;.001</td>
<td>0.12</td>
<td>26.03</td>
<td>28.74</td>
<td>25.04</td>
<td>20.18</td>
<td>1.77</td>
<td>6.38*</td>
<td>0.08</td>
<td>-8.22*</td>
</tr>
<tr>
<td><strong>Major Peeewee</strong></td>
<td>12</td>
<td>7180</td>
<td>97.42</td>
<td>&lt;.001</td>
<td>0.12</td>
<td>25.84</td>
<td>28.84</td>
<td>24.60</td>
<td>20.72</td>
<td>1.42</td>
<td>6.51*</td>
<td>-0.68</td>
<td>-7.25*</td>
</tr>
</tbody>
</table>

Note. * = $p < .01$; Highlighted cells indicate results that did not match the typical relative age pattern.
never significantly deviated from the expected distribution (all \( SR \) between -1.63 and 0.72). Finally, Q4 athletes were always significantly under-represented at each age division (all \( SR < -2.58 \)).

As a final analytical step, to determine if a sample limited to pre-pubescent female ice hockey players would result in weaker relative age effects, we compared our effect sizes to that of Weir and colleagues (2010). For Weir and colleagues’ study, the effect sizes of both their Canadian Senior National and Senior International samples were considered small: \( \phi = 0.20 \) and 0.28, respectively. Our overall sample effect size was also considered small (\( w = 0.13 \)), though the effect sizes in minor Pre-Novice (age 4; \( w = 0.22 \)) and minor Novice (age 7; \( w = 0.18 \)) more closely resembled those from Weir and colleagues’ National sample.

**Discussion**

The purpose of this study was to investigate if relative age effects existed for pre-pubescent female ice hockey players when physical maturation differences could be considered more limited. Furthermore, we focused our sample on Canadian athletes (specifically those registered in Ontario) in order to guarantee our sample was drawn from a regionally popular sport base. By examining nearly 40,000 participants 4 to 12 years old, we ensured a large female ice hockey sample collected across multiple age divisions representing the full pre-pubescent participation pyramid. Results of this study demonstrated that relative age effects exist for female ice hockey players. With minor exceptions, our results demonstrated a birth rate distribution whereby relatively older athletes (i.e., those born in the first or second quartiles) were over-represented in the overall sample. Furthermore, relatively younger athletes (i.e., those born in the fourth quartile) were consistently under-represented in the sample.

The distribution of birth dates for youth sport participants found in this study parallels the distribution discovered by Weir and colleagues (2010). Specifically, in both studies, there were more athletes born in the second quartile than the first quartile. This distribution is a recent and unique finding in relative age effects research. Initially considered a surprising result because over-representation of players born in the second quartile does not follow the classical pattern of relative age effects, this same over-representation of athletes born in the second quartile was also reported by Delorme and colleagues (2010) and Baker and colleagues (2009) for adult female soccer players. Including the current study, there are now four recent studies that note over-representations of athletes born in the second quartile in popular female team sports (i.e., Canadian ice hockey and European soccer). Our evidence adds to the growing trend of relative age effects in females being characterized by an over-representation of athletes born in the second quartile, and it does so in a reliable fashion, drawing from a very large database in a popular sport, using rigorous post-hoc tests to examine inter-quartile patterns; a pattern that diverges from the typical pattern witnessed in male sports. Such a divergence requires further exploration.

Explanations for what causes the second-quartile phenomenon are difficult to generate because of the differing samples and results used in each study. Prior to the current study, one consistent observation was that second-quartile over-representation did not appear until after the pubescent years. For example, Delorme and colleagues (2010) found that French, female soccer players were (with few exceptions) most often born in the first quartile at younger ages, and that this trend flipped around age 15, with most players afterwards being born in the second quartile. Similarly, Baker and colleagues (2009) noted athletes born in the first quartile being most over-represented for youth female soccer players (13–18 years), but those born in the second quartile being most over-represented for adult female soccer players (18 years and older). To our knowledge, our study was the first to find the largest over-representations of youth female sport participants born in the second quartile across pre-pubescent age divisions.
It is necessary to try to account for the elevated second-quartile phenomenon. One past hypothesis has been that athletes born in the first quartile might have already been recruited to play on more elite competitive teams, leaving them unaccounted for in developmental systems, which would be an interesting inquiry for future researchers. A second plausible explanation is that first quartile children may have an advantage in traditionally stereotyped activities for females. For sport, traditional activities might include gymnastics and tennis. In fact, Ste-Marie, Starkes, Cronin, and Fletcher (2000) showed that pre-pubescent Ontario gymnasts born in the first quartile were most over-represented in their sport. Such a study supports the argument that first quartile children might be choosing traditionally stereotyped competitive activities for females such as gymnastics and swimming, or perhaps even ringette, rather than ice hockey, which could explain the over-representation in the second quartile of our hockey sample. Further research into other sports is warranted in order to confirm this hypothesis of how relative age effects in traditionally stereotyped sport activities might impact relative age effects in other neighboring or competing sport alternatives that are less traditional for females.

To determine if our sample’s relative age effect was weaker than in a previous study, we contrasted our results with findings from Weir and colleagues (2010). By delimiting our sample’s age range, we believed we minimized maturational variability that accelerates during and after puberty and which is associated with factors that could increase physical performance. Our results indicated that even with a pre-pubertal sample, significant relative age effects existed across the sample. In fact, at ages 4 and 7 years, the strength of the relative age effect resembled that found by Weir and colleagues for post-pubescent National team female ice hockey players. Two possible explanations exist: First, perhaps physical maturity differences do not have as strong an impact on relative age effects as previously thought; rather, cognitive factors (e.g., perception and knowledge) might have a stronger impact on relative age effects, which could be seen in pre-pubescence. Alternatively, perhaps small changes in annual growth are significant enough to produce relative age effects. The average child from 3 years old until the beginning of puberty grows 2.5 inches in stature and 6 pounds in weight each year (Payne & Isaacs, 2011). Perhaps relative age effects begin before maturational differences are exacerbated by pubescent growth, due to normal, annual growth. These explanations are speculative and sport scientists should attempt to better understand physical maturity by implementing longitudinal designs which could speak more clearly to such issues. This would allow for more accurate conclusions regarding maturational differences and relative age effects.

Overall, our results indicate significant relative age effects for pre-pubescent female ice hockey players registered in Ontario. These results remain consistent with some previous studies (e.g., Baker et al., 2009; Delorme et al., 2010; Weir et al., 2010) showing that the most over-represented athletes were born in the second quartile. Two suggestions for future research to further explain these findings would be to examine relative age effects in traditionally stereotyped female sport and to implement longitudinal designs that could further inform researchers about the role of annual growth and pubertal growth on relative age effects.

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References


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The Influence of a Deliberate Practice Intervention on the Putting Performance and Subsequent Practice Behaviours of Aspiring Elite Adolescent Golfers

Rick Hayman¹, Remco Polman², Erika Borkoles³ and Jamie Taylor³

Abstract: Objectives: This study aimed to determine if a golf specific deliberate practice intervention would improve putting performance and influence future practice behaviours of aspiring elite adolescent golfers with no prior experience of specialised short game interventions. Method: Participants completed a 13 week AB single-subject multiple-baseline design study with social validation and five month follow up interviews. Results: The findings indicated the deliberate practice intervention to be effective in enhancing the putting performance of all participants from baseline to intervention phases. Mean performance measure scores were significantly higher in the intervention phase than the baseline phase. Social validation and follow up interviews revealed all participants enjoyed undertaking deliberate practice, experienced a range of psychological and technical improvements, adapted current training schedules to mirror deliberate practice and committed long term to activities of this nature. Conclusions: Deliberate practice has the potential to improve putting performance of aspiring elite adolescent golfers and was viewed by all participants as a key strategy in successfully bridging the gap to elite adolescent status. Findings provide support for practitioners, sport psychologists and policy makers who may wish to expose aspiring elite golfers to golf specific deliberate practice regimes for the first time during late adolescence.

Keywords: deliberate practice intervention, golf, aspiring elite, single-subject design

The extant skill acquisition literature contains a range of cognitively focussed learning theories which outline and explain the progressive nature of motor learning development from novice to elite levels of performance across a range of disciplines (Ericsson, Charness, Feltovich, & Hoffman, 2006). Examples of well-established theories of motor learning include the stages of learning model (Fitts & Posner, 1967) and the power law of practice (Anderson, 1983; Newell & Rosenbloom, 1981). The research undertaken by Fitts and Posner (1967) led them to suggest that the learning process is a progressive entity and any individual will pass through specific phases of development as they acquire new motor skills. The power law of practice theory claims motor learning occurs initially at a rapid rate after the onset of practice but that this rate of learning decreases over time as skill levels improve.

A collective feature of these cognitive approaches to motor learning is the suggestion that learning is a steady process whereby learner’s progress through three specific phases of skill acquisition termed cognitive, associative and autonomous stages as they practice a skill and learn to perform it independently (Anderson, 1982, 1983; Fitts & Posner, 1967; Schmidt & Lee, 2005). In the cognitive phase, learners try to understand what needs to be

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done to execute the skill. Their focus is on performing the task accurately and they benefit from specific feedback to guide their movements. This stage of learning is time demanding and characterised by large amounts of cognitive effort, conscious processing and high levels of explicit verbal instruction and augmented feedback. In the associative phase, performers adjust and gradually improve how the skill is performed until movements are more consistent and spontaneous. After an extensive acquisition phase, learners finally progress into the autonomous phase where the skill is performed automatically and greater volumes of practice are required to achieve smaller gains (Farrow, 2012; Schmidt & Lee, 2005).

It is well established how both quantity and quality of practice are crucial to the development of expertise and practitioners should carefully consider the micro-structure of practice sessions they prescribe to maximise the learning opportunities of their athletes (Deakin & Cobley, 2003; Ericsson, 2003). In emphasising this point, Farrow (2012, p.57) stated “practice should be a continual striving to lift performance to a new skill level such that plateaus in learning do not occur.” Opposing the frameworks of traditional theories of skill acquisition (e.g., Fitts & Posner, 1967), the Theory of Deliberate Practice (TDP) proposed by Ericsson, Krampe, and Tesch-Römer (1993) suggests the most critical aspects of expert performance are not fully automated and the expert performer must retain conscious control for further improvement of skill to occur. This theory proposes that the acquisition of expertise within any discipline is the result of undertaking approximately ten thousand hours (over a period of ten years) of physically and mentally demanding practice regimes whilst overcoming effort, motivational and resource constraints (Ericsson et al., 1993).

The theoretical framework of the theory is underpinned by the assumption that once performance becomes consistent, current training protocols would no longer be considered as deliberate practice and a performer would need to undertake a revised practice schedule that falls beyond the individual’s current competency levels and requires greater levels of physical and mental effort and conscious control. Ericsson and colleagues also stated that practicing for an extensive period of time will only result in the attainment of expertise if such activities are not enjoyable to undertake, tailored towards improving performance, require optimal resources, high sustained levels of physical effort and concentration and not completed under conditions of fatigue or low motivation (Ericsson et al., 1993). They have also emphasised the importance of increasing the complexity and challenge of deliberate practice activities, so aspiring elite performers remain cognitively engaged within every prescribed training session they undertake. They state this approach to learning enables the performer to offset automaticity of performance and retain in the cognitive and associative instead of autonomous stages of learning (Fitts & Postner, 1967). This process will then allow for the continued modification of cognitive mechanisms that mediate how the brain and nervous system control motor performance (Ericsson, Roring, & Nandagopal, 2007). This form of training also places equal standing on quality and quantity of practice and encourages performers to work beyond their current level of performance and comfort zone (Ericsson et al., 1993; Ericsson, 2007).

A number of possible explanations for superior performance following long term investment with deliberate practice populate the literature. These include improved accuracy and speed of performance upon a range of cognitive, perceptual and motor tasks including visual cue utilization, pattern recall and recognition, anticipation, decision making and visual search behaviour. For example, research undertaken by Savelbergh, Williams, van de Kamp, and Ward (2002) revealed how skilled footballers demonstrated a superior ability to pick up advance visual information from teammates or opponents postural orientation prior to a key event. Research has also confirmed how expert handball and soccer performers respectively outperformed their non-expert counterparts in sport specific pattern recognition and recall tasks (Tenenbaum, Levy-Kolker, Sade, Liebermann, & Lidor, 1996; Williams, Hodges, North, & Barton, 2006).
Support for TDP is wide ranging across several domains, including sport, with evidence reinforcing the view that long-term exposure with deliberate practice is a crucial hallmark for the attainment of elite level sporting excellence (see Williams & Ford, 2008 for a review). The first studies which examined the applicability of the theory towards developing expert sports performers were undertaken during the mid to late 1990’s by Hodges and Starkes (1996), Helsen, Starkes, and Hodges (1998) and Hodge and Deakin (1998). Collectively, these studies supported the viewpoint of Ericsson and colleagues as a monotonic relationship between accumulated hours of deliberate practice and performance level was reported in figure skating (Starkes et al., 1996), soccer and field hockey (Helsen et al., 1998) and karate (Hodge & Deakin, 1998). More recent support for the theory was also reported in soccer (Helson, Hodges, Van Winckel, & Starkes, 2000; Ward, Hodges, Williams, & Starkes, 2007), rhythmic dancing (Law, Côté, & Ericsson, 2007), middle distance running (Young & Salmela, 2002) and triathlon (Hodges, Kerr, Starkes, Weir, & Nanandou, 2004).

Collectively, this body of research retrospectively examined both the accumulated hours of deliberate practice undertaken in addition to levels of enjoyment, relevance, physical effort and concentration experienced by elite senior level sports performers. The findings revealed how they were first exposed to and undertook significantly more hours of deliberate practice when compared to their intermediate and recreational level counterparts.

This initial sport specific deliberate practice research was also responsible in the evolution of the theory over the past 15 years. Firstly, it is important to remember how TDP emerged from research within the musical and chess disciplines which are activities that don’t require the performer to undertake physically demanding movements. However, the findings by Hodges and Starkes (1996) refined the definition of deliberate practice within a sporting context because participants of different standards were required to provide insights into the intensities of both concentration (mental effort) and effort (physical effort) exerted throughout their developments instead of providing a unique rating for effort. The study further revealed how the elite wrestlers tended to enjoy undertaking all their deliberate practice activities.

Novice participants have shown rapid improvements in golf performance after short term exposure to laboratory based golf specific practice interventions (e.g., Lam, Maxwell, & Masters, 2010; Maxwell, Masters, & Eves, 2003). However, the efficacy of these studies in terms of developing training regimes for promising adolescent golfers is low because participants tend to be beginners who are situated in different stages of the learning process from more accomplished performers. To our knowledge the present study is the first to examine the influence of a golf specific deliberate practice intervention upon the performance and future practice behaviours of promising adolescent golfers who had no previous experience of undertaking specialised golf specific training regimes.

Single Subject Designs (SSD) have become a popular approach with sport psychology to assess the efficacy of mental skills interventions including goal-setting, imagery, self-talk, hypnosis and relaxation techniques upon components of athletic performance (Calmels, Berthoumieux, & d’Arripe-Longueville, 2004; Jordet, 2005; Munroe-Chandler, Hall, Fishburne, & Shannon, 2005; Thelwell & Greenlees, 2001, 2003). These studies are characterised by their small and specified sample sizes (e.g., between three and five elite or aspiring elite level performers) and reliance on the subjective assessment criteria to identify any individual differences in performance between participants (see Kinugasa, Cerin, & Hooper, 2004 for a review).

As opposed to skill acquisition studies that have adopted group designs, an AB SSD across multiple baselines approach (Martin & Pear, 1996) was considered as the most appropriate method to use in the current study. This decision was based on the fact that we wanted to detect any change in performance level of promising adolescent golfers who were situated in a phase of the learning process where improvements in performance may be difficult to discover using traditional significance group based
testing procedures. The aim of the SSD approach is to observe participant outcomes (e.g., performance measures) as a dependent variable at multiple time points prior, during and after the implementation of an intervention and to compare any changes (Kinugasa et al., 2004). SSD approaches also eliminate the need for a non-treatment control group and enable an individual’s performance level to be observed over an extended period of time. Further justification for using this approach with sports performers displaying promise to achieve eventual adolescent golfing excellence was provided by Wollman (1986) who stated:

Single subject designs allow detection of successful effects for certain individual subjects who otherwise might have their success masked in a non-significant group. Single subject methodology may also be better suited than group designs in working with skilled athletes who will not improve much from pre-training level. Small but consistent changes may be seen in a single subject design but not emerge significantly in a group design. (p.136)

Another reason why a SSD was used was because they have the potential to be more effective at controlling threats to internal validity such as carry over effects than reversal designs (Kinugasa et al., 2004). Further support for the usefulness of this method in detecting changes in performance when undertaking research within a sports coaching context has been recently provided by Harwood and Steptoe (2013).

The primary aim of this study was to determine if the introduction of a deliberate practice putting intervention was associated with improvements in short game golf putting performance of skilful but non-elite adolescent golfers who had no prior experience of undertaking intensive putting specific training interventions. The second aim was to inspect the participant’s experiences of the intervention and the subsequent impacts upon future practice trends and behaviours.

**Method**

**Participants**

Participants were five (age: $M = 16.50$ years, $SD = 0.76$) aspiring elite male adolescent amateur golfers with a handicap ranging between three and one ($M = 1.40, SD = 0.95$). The competitive playing experience of the sample ranged between two and five years ($M = 3.8, SD = 1.3$). Throughout the study, all participants were affiliated with their respective county’s Under 18 representative teams, which comprised Lancashire, Cheshire and Yorkshire. They were also full time first year students upon a golf specific Advanced Apprenticeship in Sporting Excellence (AASE) qualification which was delivered at an academic institution located in Northern England.

The nature of previous golf participation and practice trends prior to enrolment upon the course was verified by golf coaches at the institution who retrospectively interviewed the participants and their parents at two separate stages of the selection process for the AASE programme. This revealed how all participants had encountered a diversified introduction to several sports since early childhood, which included golf, within a playful, fun, non-competitive environment that resembled key tenets of deliberate play theory (Côté, 1999). A change in emphasis towards specialising in golf occurred around the ages of 14–15 once participants had gained initial selection for county representative golf teams. Informed consent was obtained from all participants prior to any investigatory proceedings and ethical approval was granted by the local university ethics committee.

Throughout the duration of the putting study, the AASE programme did provide participants with the opportunity to partake in golf activities. However, amounts of competition and practice undertaken throughout this 13 week period were reflective of their previous day to day activities prior to enrolment upon the course due to the timing (golf off season) and time spent fulfilling the academic components of the course. The golf provision undertaken outside of the prescribed deliberate practice intervention comprised 18 hole practice rounds and long game practices at the driving range. Participants also completed off course activities strength and conditioning and
cardiovascular fitness training within this 13 week period. In an attempt to increase the likelihood that any improvements in putting performance were a result of the deliberate practice intervention and not the additive effect of any additional putting practices, the head coach instructed the sample to use the deliberate practice intervention as the only means of practicing their short game putting over the duration of the 13 week study.

**Apparatus**

Participants used their own putter and golf balls to perform the weekly performance measure and prescribed deliberate practice drills. The putting surface used for all 13 performance measures was a grass section of the outdoor putting green located at the academic institution. The same hole was used over the 13 week period and the surface was flat, level and maintained by professional green keepers on a daily basis to maintain the same level of putt difficulty from week to week (e.g., slope and break). This helped to ensure that any improvements in performance measure scores could be attributed to increased skill levels related to deliberate practice rather than decreased task difficulty. The performance measure was created by precisely inserting ten golf tees around the circumference of a golf hole. The distance from all ten locations to the centre of the hole was eight feet. The deliberate practice drill was created by inserting ten separate golf tees into the ground from 3, 6, 9, 12, 15, 18, 21, 24, 27 and 30 feet respectively from the hole.

**Procedures**

The lead author attended an AASE squad development training day at an academic institution in early September 2010. This enabled him to inform all squad members about the nature of a mixed methods study he was undertaking which would examine the effects of undertaking “effortful golf practice on short game putting performance and future practice behaviours” and to emphasise the commitment required. The lead researcher randomly selected 5 squad members to participate in the study based on the premise that if self-selection was used, then a strong motivational effect to improve performance may underlie any positive findings to emerge from the study instead of increased skill levels through exposure with deliberate practice. Quantitative and qualitative data were collated via weekly performance measures, self-report diary logs and social validation and five month follow-up interviews. The self-report diary log provided instructions including the number of times the weekly performance measure and deliberate practice intervention were to be completed by each participant. It also required participants to record subjective ratings for physical and mental effort exerted and fun encountered for every deliberate practice drill they completed on a scale of zero (‘very very low’) to ten (‘very very high’). A brief written justification for each rating and the time it took to complete the session was also recorded.

One week prior to the start of the study, all participants attended a one hour seminar delivered by the lead author at the institutions golf academy which reinforced what was expected of them over the duration of the study and allowed additional clarification to be provided for those who were unsure. A demonstration of how to complete the deliberate practice intervention and weekly performance measure was also provided by the lead researcher on the institutions outdoor putting green to all participants and all questions posed were addressed. Each participant also completed a pilot run of creating the correct measurements from the hole for each shot to be played during the intervention drill. To aid their understanding of deliberate practice, participants were also provided with the following definition within their self-report diary logs “deliberate practice is as a highly structured activity that requires maximal physical and mental effort, is not intrinsically enjoyable to undertake, generates no immediate rewards and is performed solely for performance improvements” (Ericsson et al., 1993).

Two professional golfers piloted the deliberate practice drill prior to the study commencing. This confirmed how the drill was challenging, required maximal physical
and mental effort throughout and took approximately 30 minutes to complete the 20 putts that comprised one run through of the intervention. This finding fits well with the recommendations made by Ericsson et al., (1993) who recommend the maximum amount of time spent undertaking deliberate practice regimes on a daily basis should initially be approximately 20–30 minutes for participants with no previous experience of intensive training strategies.

The study commenced with all five participants performing a baseline period (5, 6, 7, 8 or 9 weeks respectively) in addition to their normal golf participation trends discussed previously. The nature of these activities (e.g., marginal amounts of time spent undertaking short game specific putting practice) also strengthens the support for how any improvements in putting performance could be traceable to the deliberate practice intervention. During this time, once a week, each participant completed a generic weekly performance measure, which comprised ten separate eight foot putts from around the circumference of the hole. Participants were awarded one point if a putt was successfully holed. If the putt missed the hole, no point was awarded which meant that the final score obtained each week was located between zero and 10. Using the same hole and starting at the same point every week, each participant moved around the circumference of the hole in a clockwise direction to execute ten shots in total. This was repeated over the course of 13 consecutive weeks.

The deliberate practice intervention was sequentially introduced from week six of the study with all participants undertaking the specialised putting training by week ten. The lead author and head golf coach at the institution developed a short game putting drill that fitted the theoretical framework of a deliberate practice activity. Specifically, the task was intended to be challenging to complete, required sustained concentration and was designed with the sole purpose of improving performance rather than for enjoyment. Informed by the findings of the pilot studies, each participant was projected to undertake between 90–120 minutes of golf putting specific deliberate practice per week during the intervention period. Participants individually completed one deliberate practice intervention drill on four consecutive days (Monday–Thursday). All performance measures were undertaken 24 hours later (Friday) with scores recorded by the lead author and stored in a secure place.

Participants started each drill by performing a 3 foot putt from the hole and then played one putt at the same hole from 6, 9, 12, 15, 18, 21, 24, 27 and 30 feet respectively. This process was undertaken twice resulting in the total number of putts made within each intervention practice totalling 20. Successful putts were awarded two points and a score of minus one was awarded for unsuccessful putts. The maximum and minimum scores available ranged from minus 20 to 40. Each participant undertook four drills each week during the intervention stages of the study. Therefore, participant one who undertook an eight week intervention period was scheduled to undertake 32 separate drills (totalling 640 practice putts) and participant five who undertook a four week intervention period was scheduled to undertake 16 separate drills (this totalled 320 practice putts).

Participants were instructed to use the same starting point on the drill over the course of the study and keep a record of their score. This information was not included in any stage of the data analysis process of the study. Participants were informed not to discuss the putting performance scores obtained throughout both the intervention drills and performance measures with other participants so the risk that any improvements could be attributed to motivational instead of skill acquisition changes was minimised. All intervention practice sessions and performance measure schedules were completed individually.

Self-report diary logs were maintained by all participants throughout the intervention phase of the study. Participants were instructed to complete the diary log immediately after a practice drill was completed. Manipulation checks were also undertaken by the lead author who inspected diary logs twice per week during the intervention phases to
ensure data was inserted correctly and too track adherence levels to prescribed practice schedules.

In compliance with sport psychology studies that have employed SSD in the past, (e.g., Thelwell & Greenlees, 2001, 2003) participants also undertook a social validation interview which comprised eight questions in the week after the study was completed. This allowed the lead researcher to obtain insights into the participant’s experiences and perceived effectiveness of the deliberate practice intervention as a mechanism for improving their golf putting ability. All interviews took place at a location of the participants’ choice which in all cases was the institutions golf academy and lasted approximately 20 minutes.

All participants were followed up five months after the completion of the study. Eleven predetermined questions were asked to establish the types, microstructures, and intensities of golf activities undertaken during these five months. All interviews took place at the golf academy at the institution and lasted approximately 30 minutes.

Data Analysis

SSD

Weekly performance data during baseline and intervention were plotted and visually examined to determine if consistent effects were established during intervention using the following guidelines proposed by Hrycaiko and Martin (1996): (1) stable baseline performance; (2) replication of effect within and across participants; (3) number of overlapping data points; (4) timing of effect following introduction of treatment; and (5) size of effect in comparison to baseline.

Self-Report Diary Logs

Mean participant ratings and standard deviations for physical effort, mental effort and fun were calculated for each participant during the intervention stage of the study. This data was then tallied and divided by five to produce grand means and standard deviations for each of the three dimensions.

Social Validation and Follow up Interviews

Both the social validation and follow up interview data were analysed using the same analysis procedure. Once all interviews were completed, they were transcribed verbatim and the text was read on several occasions over a 14 day period to increase the lead author’s familiarity with the data. Once the transcribing process was complete, content analysis following the recommendations of Côté, Salmela, Baria, and Russell (1993) was used to identify repeated patterns of meaning provided by the participants in response to the questions posed. This qualitative analysis procedure involved organising and generating themes from interview data to identify recurring themes.

Firstly, each transcript was subjected to inductive line by line analysis by the lead author to identify individual meaning units and raw data themes within participant quotations. Once these initial statements were compiled, an inductive analysis of the data was undertaken throughout the early stages of the analysis process to develop higher order themes that linked similar raw data themes together in a higher order concept. Similar themes were grouped together as either positive or negative perceptions of the intervention. The next step involved the creation of profiles which reflected the major findings for each individual participant. After this point, deductive analysis was employed to refine and develop emergent themes. Finally, several steps were taken to ensure the trustworthiness and validity of the data collated. Firstly, in recognising the risk of miscoding during the data analysis process, a collaborative approach was taken to increase the validity of data which involved an independent researcher who was blind to the aims and objectives of the study scrutinising the analytic processes employed. A high
level of agreement was found for both sets of interview data and the minor disagreements concerning interpretations were all solved after a short discussion between the two researchers. Secondly, validity was checked for separate interviews using respondent validation techniques (Patton, 2002). The lead author made contact with all participants via phone to discuss the accuracy of the data analysis procedure and their satisfaction with the truthfulness of the constructs which emerged. This member checking exercise involved the participants answering a sample of verification and clarification questions which aimed to provide further depth to the data that was already created and reduce ambiguity (Lincoln & Cuba, 1985).

**Results**

**Part One: Visual Inspection of Data**

A reasonably stable baseline and prompt improvement in performance during the intervention stage was experienced by participant one (see figure 1a). No overlapping data points across the two phases support the effectiveness of the intervention in enhancing putting performance. A consistent improvement in putting accuracy was evident compared to baseline data across all eight weeks of the intervention. Mean scores for successful putts at baseline and intervention were 3.8 and 6.1. The increase in performance for participant one was the largest of the five participants in the study with a 61% improvement between mean baseline and intervention performance measures.

![Figure 1a. Participant one weekly performance measure score.](image)

![Figure 1b. Participant two weekly performance measure score.](image)
Participant two demonstrated a relatively stable baseline and one overlapping data point during the first week of intervention (see figure 1b). Putting success increased gradually between weeks seven and ten although performance plateaued during the final four weeks of the study. Mean baseline and intervention measures were 4.7 and 6.3 and the increase in performance for participant two was reasonably large with a 34% improvement between mean baseline and intervention performance measures.

Again participant three had a stable baseline performance during week’s four to seven. Similarly to participant two, only one cross-over data point was observed throughout the baseline period and intervention which provide partial support for the efficacy of the intervention (see figure 1c). A slight decrease in performance during the final two weeks of intervention was evident but no overlap with baseline data occurred. Mean baseline and intervention measures were 5.4 and 7 and the increase in performance was moderate with a 30% improvement between mean baseline and intervention performance measures.

Baseline data for participant four were initially unstable but stabilized during weeks five to eight (see figure 1d). Weekly performance measures didn’t improve after exposure to the intervention and whilst performance levels became more consistent during the final weeks.
three weeks of the intervention, there was a crossover of data points between baseline and intervention data on five occasions. Mean baseline and intervention measures were 4.7 and 5.6 and the increase in performance for participant four was relatively weak with a 19% improvement identified between mean baseline and intervention performance measures.

Baseline data for participant five was relatively stable but showed gradual decline in putting performance during weeks four to eight in comparison to weeks one, two and three (see figure 1e). Performance during the intervention stage was consistent although no improvements in putting scores were evident when compared to baseline. Participant five encountered four overlapping data points which suggests the impact of the intervention upon performance was low. Mean baseline and intervention measures were 5.2 and 6 and a 15% improvement between mean baseline and intervention performance measures was observed.

Performance data during the final four weeks of baseline were reasonably stable for all five participants. Participant three obtained a score of six on all four occasions, whilst the other four participants obtained the same score on three out of four occasions with the other measure being one less each time. Replication of the treatment effect occurred for three of the five participants. Clear performance improvements during intervention were evident for participants one, two and three which ranged in size from large (participant one) to relatively large (participants two and three). Participants four and five provide partial support for a replication effect and highlight how improvements in consistency of performance occurred during the intervention phase of the study (see table 1).

![Figure 1e. Participant five weekly performance measure score.](image)

### Table 1. Mean (SD) Baseline and Intervention Performance Measure Scores (0–10) and Percentage Differences

<table>
<thead>
<tr>
<th>Participant</th>
<th>Baseline score</th>
<th>Intervention score</th>
<th>% Difference (+ or -)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.8 (0.45)</td>
<td>6.1 (0.35)</td>
<td>61%+</td>
</tr>
<tr>
<td>2</td>
<td>4.7 (0.52)</td>
<td>6.3 (0.76)</td>
<td>34%+</td>
</tr>
<tr>
<td>3</td>
<td>5.4 (0.79)</td>
<td>7 (0.63)</td>
<td>30%+</td>
</tr>
<tr>
<td>4</td>
<td>4.7 (0.71)</td>
<td>5.6 (0.55)</td>
<td>19%+</td>
</tr>
<tr>
<td>5</td>
<td>5.2 (0.67)</td>
<td>6 (0)</td>
<td>15%+</td>
</tr>
<tr>
<td>Grand mean</td>
<td>4.8 (0.56)</td>
<td>6.2 (0.46)</td>
<td>31.8 (18.08)</td>
</tr>
</tbody>
</table>
Results Part Two: Self-Report Diary Log Measures

Analysis of self-report diary log data revealed adherence levels to prescribed training protocols were extremely high with 116 out of the 120 (97%) prescribed deliberate practice drills completed. Participant four was unable to complete any of the four prescribed practice drills during week 12 of the study due to illness although he was able to complete the weekly performance measure. The grand mean subjective ratings for physical and mental effort and fun were 9.1 ($SD = 1.04$), 9.1 ($SD = 0.98$) and 9.3 ($SD = 0.85$) respectively, which implies how participants enjoyed undertaking the drills yet also invested considerable amounts of physical and mental effort into every prescribed practice drill.

Results Part Three: Qualitative Analysis

Social Validation Interviews

The results of the data analysis yielded six sub-ordinate themes that were subsequently grouped into the following two super-ordinate themes: Psychological Benefits of Intervention and Technical Benefits of Intervention. For the purpose of this paper we have only included one quotation per theme.

Psychological Benefits of Intervention

Motives to Practice. Participants discussed how they enjoyed the intervention and that it increased their motivation to practice which had generally been low throughout the past year as they preferred to play competitive rounds with peers:

This was something really different but useful for me to get better and it was so much harder doing that than playing nine holes with my mates. This is the best block of training I have ever done and I actually really liked doing it and it has sort of made me realise I can be really good at this game if I work hard enough. (P2)

Increased Self-Efficacy. The intervention appears to have increased the short game specific self-efficacy levels of participants; Participant three stated:

I liked the drills as they made me realise I’m actually a good short game player although I never believed it and what my dad used to say that I’m good is right really.

Increased usage of Mental Skills. The intervention appears to have increased usage of mental skills such as concentration and goal-setting within prescribed practice drills. For example, participant two said:

We learn these mental things in class about psychology and John (lecturer) always says to use them but I never used them really but I did in the drills as they were hard and I thought they would help and I took my time and went through my routines that I have and it seemed to have been good for my performance.

The challenging nature of the deliberate practice drills stimulated an upsurge in the levels of mental effort the participants placed into their normal practice routines:

The drill was hard and needed really focussing on which I liked as I don’t really do this at all normally in practice or in my matches. (P1)

Long Term Commitment to Deliberate Practice. The majority of participants revealed how they would commit long term to golf specific deliberate practice in the future with a particular emphasis on improving their short game performance levels. For example, participant two said:

This is so different to what I normally do but I’m sticking with it because it will get me to where I want to be in a few more years’ time once I have finished college.

Technical Benefits of Intervention

Stroke Play. There was evidence to suggest how participants thought the intervention was beneficial for their technical putting skills. Participant one for example stated.

My stroke play is better but I just think how many times I have played that drill and similar shots since the start of term. It is a lot but it really has made it better.
**Shot Shaping.** Participant three explained how the intervention improved his shot shaping:

*My shape has become so much better with all the time spent doing your drills and even my dad said so when I played on Sunday with him and my uncle.*

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**Five Month Follow up Interviews**

Analysis of follow up interview data generated two super-ordinate and six sub-ordinate themes. The results of the data analysis yielded six sub-ordinate themes that were subsequently grouped into the following two super-ordinate themes: Strategic Approach to Practice and Improved Psychological Approach to Golf. Exemplar quotations are also presented to illustrate particular concepts that emerged from the study.

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**Strategic Approach to Practice**

**Allegiance to Short Game Deliberate Practice.** Prior to the intervention, participants were typically prescribed generic practice sessions of 60–90 minutes in duration by parents and institutional coaches that focussed on more than one facet of the game, involved predominantly a lot of course play and didn’t require a great deal of effort to complete. For example, participant one said:

*My golf routine was just practicing on the course really, nine holes in the morning and nine in the afternoon during the holidays and summer and hardly anything in the winter except for the games for my club.*

After completing the intervention, participant three reported undertaking larger volumes of practice each week than ever before:

*I have spent much more time recently on the greens instead of travelling around and playing on the college tours and if you would have asked me that at the start of the year I would have laughed as I was just play all the time thinking this was the only way to improve.*

Exposure to challenging, high quality short game practice also coincided with increased short game skill development and self-initiated behaviours. Participants started to become receptive of the new deliberate practice regimes and positive in their outlook as they had started to see benefits in relation to short game skill improvement. The following quote emphasise the nature of their new training environments.

*I now use lots of putting practices instead of just moping around the putting green and hitting random shots. (P1)*

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**Long Term Commitment to Deliberate Practice.** The modified approach to practicing has initiated a change in the golfers’ attitude to golf and they reported to be more focused on achieving golfing excellence and scaled down their involvement in various extracurricular activities and leisure pursuits that were commonplace prior to the intervention. For example, participant one said:

*I have started to live a bit like a golfer who wants to become a professional should be doing. I’ve started to put the work in on the greens now when I wouldn’t have done so in the past but this really matters and I don’t want to think what if in a few years.*

The majority of the participants reported a greater confidence in their golf ability, especially their short game. They discussed how they are striving more than ever to successfully bridge the transition from aspirant to elite adolescent then senior level golfer through long term engagement with deliberate practice. The narrative below emphasise how participant four views long term commitment to deliberate practice as central in their quest for excellence.

*I have concentrated much more just on golf this last few months than ever before and I have realised I am a better golfer than I thought I was and I have surprised myself just how much more work I have started to now put into my game.*

After short term exposure to deliberate practice, participants started to enjoy the nature of the practice more and observable improvements in weekly testing protocols were
evident. The following quote illustrates the realisation that deliberate practice can aid expert performance.

The pro at my club has been telling me I need to do this hard practice for months now and even showed me some drills to do but I wasn’t so bothered as my handicap was coming down anyway but if I do this as well then it might come down more in the future. (P2)

**Significance of Deliberate Practice in Pursuit of Excellence.** Undertaking deliberate practice activities was found to guarantee an intensity and focus that was never previously evident in the daily practice regimes of participants.

Whenever I do my practice now I always set myself hard tasks that make me work hard and focus as I do not see the point anymore of going onto a putting green for example and just putting holes. (P3)

All participants discussed their allegiance to long term deliberate practice and the realisation that such provision has a key role to play in both fulfilling their potential and facilitating their pursuit of golfing excellence. A number of participants were also initially wary of the new practice regime and found it to be tedious, but they soon realised its long-term significance once the intervention commenced. Participant three’s narrative illustrates this point.

I was a bit like what is this all about at the start but I gave it a go and it's really grown on me and I even do it sometimes in the morning on my own now before classes start.

**Improved Psychological Approach to Golf**

**Promotion of Critical Self-Reflection.** Participant three discussed how undertaking regular deliberate practice helped him to improve his golfing skills:

If you want to identify your weaknesses and strengthen them then the best way to do this is through using these types of practices.

Participant four stated how undertaking deliberate practice has helped him to identify the strengths and weaknesses in his game:

Deliberate practice tells you the truth and you can’t hide from it. If you are playing badly it will show up but I think this is good because it makes you aware of what you are doing well and also where you need to spend time working.

Post practice reflections over the course of the past five months helped these golfers to evaluate the standard of their practice. Involvement in the intervention has also fostered self-reliance, autonomy and heightened awareness of the antecedents believed integral for achieving and maintaining golfing excellence. To illustrate, participant one stated:

I have grown up as a golfer and a student really since I came here (Institution) and I now act like I should have done two years ago. I think this new approach to golf (undertaking regular deliberate practice) has helped this and even my mum has noticed it when I go home some weekends and I’m always out of the house practicing my golf or doing my reflection portfolio for class.

**Psychological Benefits of Deliberate Practice.** After five months it was still evident that there was an increase in participants self-discipline and dedication towards their golf development. The following narrative by participant three highlights the significance of doing deliberate practice:

What I have learned through training this way is that you must have patience with golf and it is not about looking a couple of months into the future but six or seven years into your career.

There is no doubt that exposure to a complex, demanding and challenging learning environment was advantageous for the refinement of numerous mental skills including goal setting and imagery. For example, participant one stated:

I use all the psychology that the coaches tell us about in my practice and games now which I never did but I have given it a good go and use the goal setting and imagery stuff all the time now.

All participants discussed how both their attitudes and time dedicated towards the psychological aspects of golf have altered as a result of undertaking deliberate practice. Participant five’s narrative highlights how his mental attitude to training and practice has changed compared to five months ago:

I have been really working on the mental side of the game and how I deal and manage myself on the course and trying to stop thinking about other things whilst playing.
Participant three discussed how dedicating time for setting goals proved beneficial in facilitating both enjoyment of practice and confidence in ability.

As long as you set yourself goals on all the different tasks it can’t not be enjoyable because you just want to beat your score from last time and this is great for confidence.

These quotes demonstrate how participants increased their ability to use psychological skills including imagery and pre-shot routines.

**Discussion**

In agreement with TDP (Ericsson et al., 1993), the findings of this study lend support to the role of deliberate practice as an effective strategy for increasing short game putting ability of aspiring elite adolescent golfers. All participants achieved improvements in performance (15%–61%) with the largest and most consistent increases observed in participants one, two and three who’s performance measures during the intervention remained above the levels obtained at baseline. The largest performance improvement within the sample was achieved by participant one who spent the longest amount of time undertaking the deliberate practice intervention and conforms to the power law of practice which suggests skilled performers who undertake the largest amounts of deliberate practice will encounter the greatest improvements in performance.

During the intervention participants four and five’s performance measures also stabilised, which is important for consistent scoring and has implications for total tournament outcomes in elite golf (Alexander & Kern, 2005). Long-term sport specific deliberate practice from early childhood is common within physically demanding sports like rhythmic gymnastics and this early specialisation approach has been shown to aid the ability to compete at the world class level at younger ages (Law, Côté, & Ericsson, 2007). However, the present study highlights how aspiring elite adolescent golfers who encountered diversified sporting backgrounds during their early childhood and adolescence can benefit their performance levels from exposure with specific deliberate golf practice relatively late in their talent development pathway.

Themes which emerged from the social validation and follow up interviews emphasise how the intervention was generally well received by participants, clearly enhanced intrinsic motivation and had an influential impact on their long-term approach towards developing as a golfer. In line with the predictions of self-determination theory (Deci & Ryan, 1985), the high task focus post intervention appears to have fostered higher levels of intrinsic motivation towards golf. Indeed, since undertaking the study, participants have become gradually more ambitious in terms of their golf career aspirations.

Participants also demonstrated a long-term commitment to golf specific deliberate practice regimes as they recognised its value in acquiring greater golfing skills. This conforms to previous research that highlights how sports performers become increasingly committed and self-determined in their quest for excellence as they grow older (Côté, 1999; Schoon, 2000; Treasure, 2001). These finding also fit well with perceived competency motivational theory which suggests how individuals are more likely to strive for excellence and dedicate the time needed to undertake the required training regimes in areas where they can demonstrate proficiency (Harter, 1981). In agreement with previous research (e.g., Ryan & Deci, 2000), our findings further imply that when participants develop higher levels of competence they are more likely to remain engaged and adhere to those activities.

Replicating previous findings from the extant sport specific deliberate practice literature (e.g., Hodges & Starkes, 1996), participants also enjoyed undertaking deliberate practice drills and the challenge of participating in the study which is contrary to the findings of Ericsson et al. (1993) who conceptualised deliberate practice as an activity that should not be inherently enjoyable or fun to undertake. This aligns with the findings of Nicholls, Polman, and Levy (2012) who showed how challenge appraisal in competitive athletes is
associated with positive emotions which resulted in the usage of more problem focussed coping strategies that is related to self-regulated learning (Zimmerman, 2002, 2006). Participants were also willing to devote time to undertaking the deliberate practice and reported high levels of fun throughout.

The interview data also emphasised how the participants had come to realise the importance of engaging in regular deliberate golf practice if they were to make progress towards accomplishing their long term goal of becoming an elite senior level golfer. Therefore, one of the key practical implications of this study is that deliberate golf practice can stimulate self-determined critical reflection (e.g., the capability to individually recognize and work on weaker aspects of their game), self-monitoring and independence of learning that are essential for success at the elite levels of sport (Jonker, Elferink-Gemser, & Visscher, 2010; Jonker, Elferink-Gemser, Toering, Lyons, & Visscher, 2010). In this regard, those involved in golf development systems and high performance coaching may wish to create increasingly autonomy supportive learning environments that encourage aspiring elites to take greater control over their thoughts, feelings and actions from a young age (Baumeister & Vohs, 2007). Participants also reported how they placed more mental and physical effort into their daily golf activities and demonstrated greater responsibility for their own development since undertaking the intervention. Indeed, we observed a shift in reliance on significant others (e.g., parents, coaches) for providing performance related practice and competition guidance to self-initiated and autonomous decision making behaviours post intervention. The follow up interview data also resonate with achievement goal theory (Nicholls 1984, 1989) as exposure with deliberate golf practice encouraged participants to evaluate their golf performance from an increasingly task instead of ego orientated perspective. Specifically, increasing focus was now placed on self-referenced rather than normative judgements of competence and mastery.

**Limitations**

A criticism of this study relates to the lack of ecological validity as intervention effects were judged in a non-competitive instead of a competitive golf environment. The objectivation of successful and unsuccessful putts was assured by an encoding system differentiating successful and unsuccessful putts. Future studies however may wish to use a more precise instrument (e.g., distance of ball from rim of hole) which may lead to a better understanding of changes in performance. Also, the intervention drill data could have been analysed as it may have supported the premise that sustainable learning was induced by exposure with the deliberate practice drills. Also, some of the themes that emerged from the interviews may have had a mediating effect on putting performance. For example, the fact that mental skills were used more frequently as a function of deliberate practice may have influenced the results. Finally, the study did not quantitatively measure any attitudinal or behavioural changes pre and post intervention. Therefore, in addition to follow-up interviews with participants, the completion of inventories such as The Mental Skills Questionnaire (Bull, Albinson, & Shambrook, 1996) on a frequent basis over the duration of future studies is encouraged

**Conclusion**

In conclusion, this study demonstrates the usefulness of a late golf specific deliberate practice intervention for improving short game putting performance and altering the adolescent golfers’ long-term attitude and behaviour towards the microstructure of future practice trends. All participants demonstrated at least a stable improvement in test performance and made a commitment to embed deliberate practice into on-going golf training schedules. These findings provide important practical implications to golf practitioners, applied sport psychologists and policy makers who are responsible for the design of future golf development systems.
Note
A template of the self report diary and interview schedules for the social validation and follow up interviews are available on request from the first author.

References


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Making It to the Top in Team Sports: Start Later, Intensify, and Be Determined!

Karin Moesch\textsuperscript{1,2,*}, Marie-Louise Trier Hauge\textsuperscript{1}, Johan M. Wikman\textsuperscript{1}, and Anne-Marie Elbe\textsuperscript{1}

Abstract: It is debated whether young athletes need to specialize early, or if it is more beneficial to follow the path of early diversification. The present study investigates the career paths and related motivational and volitional factors of Danish elite and near-elite team sport athletes. Seventy-six athletes matched by sport, age, and sex participated in the study. Elite athletes started their career later and showed higher self-determination and lower values in postponing training. The logistic regression showed that fewer accumulated training hours up to age 12, but more up to age 15 significantly predicted elite group membership. All other investigated variables did not show significant results. It is concluded that there are more similarities than differences between the two groups.

Keywords: career development, diversification, specialization, motivation, volition

Career Development in Team Sports

The question of how to achieve peak performance is central in elite sports. Researchers within all domains of sport sciences invest considerable effort in gaining knowledge about which variables and processes lead to winning international medals. Within social sciences, and from a developmental perspective, a controversial question concerns which career path leads to expert performance. Based on the “Developmental Model of Sport Participation” (Côte, Baker, & Abernethy, 2007) two ways to reach elite performance are described. The path of early specialization focuses on early involvement in the main sport, often occurring in early to middle childhood, with very little or no involvement in other sports. The importance of a high amount of deliberate practice is stressed during all ages (Ericsson, Krampe, & Tesch-Römer, 1993). Originally, deliberate practice was defined as activities that are specially designed to improve performance relevant to the particular domain, that are effortful and not inherently enjoyable (Ericsson et al., 1993). However, Deakin and Cobley (2003) conclude that no practice activity in sports has yet been judged highly relevant and effortful, while simultaneously scoring low on enjoyment. Moreover, many activities that constitute a normal practice regimen of an elite athlete may not improve performance per se, but aim at enhancing required levels in certain domains (e.g. physical training) that lead to increased performance (Ward, Hodge, Williams, & Starkes, 2004). Therefore, it is suggested to define deliberate practice in sport in a broader sense than initially suggested by Ericsson et al. (1993), including all activities aimed at increasing the current level of performance. Additionally, emphasis is placed on constraint factors including motivation and effort, which are considered important to maintain the hard, and sometimes monotonous, training regime (Ericsson et al., 1993). In contrast, the path of early diversification postulates that the first years of sport participation should be characterized by the involvement in different sports as well as a high amount of play-like practice that has little focus on deliberate practice activities. After these sampling years, often around age 12, the young athlete gradually reduces involvement in other sports and begins focusing on the main sport. From there, the athlete progresses to

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a highly deliberate practice regime at around age 16 (Côté et al., 2007). The two paths will be described in more detail in the next sections.

**Elite Performance Through Early Specialization**

Emerging from Ericsson et al.’s (1993) theoretical framework, this path postulates that in order to achieve expertise, one must engage in 10,000 hours of deliberate practice within the chosen domain. The theory is based on a well-documented, strong and positive relationship between amount of practice hours and performance found in the music domain (Ericsson et al., 1993). Ericsson et al. also argue that the accumulation of these practice hours must match sensitive stages of the biological and cognitive development during childhood and adolescence. Wollny (2002) states that prior amount of motoric experience is the decisive factor for how quickly new sport techniques are learned and that simple movements are learned faster by children than by teenagers and adults. In order to accurately exploit these sensitive stages and prevent a delay compared to peers that started earlier, it can be hypothesized that an early onset in a given sport is required to reach expert performance and to be competitive with other athletes. A logical conclusion of the paradigm is that an early start in a given sport is a necessary requirement to reach expertise and to prevent a practice delay compared to peers who started their sport involvement earlier.

There is extensive scientific evidence from different sports that supports a positive relationship between practice hours and expertise level (e.g. Baker, Côté, & Deakin, 2005a; Baker, Deakin, & Côté, 2005b; Helsen, Starkes, & Hodges, 1998; Hodges & Starkes, 1996; Hodges, Kerr, Starkes, Weir, & Nananidou, 2004; Law, Côté, & Ericsson, 2007). In order to persevere on the long and strenuous path to expertise, including deliberate practices that are not considered inherently enjoyable, Ericsson et al. (1993) suggest three domains to be essential in developing expertise. Aside from resource constraints (e.g. access to training facilities and coaches or parental support), which play a crucial role in the development of elite sport performance (Holt & Dunn, 2004; Van Yperen, 2009; Baker & Horton, 2004), Ericsson et al.’s focus is on motivation and effort. The *motivational* constraint refers to an individual’s goal commitment. Motivation plays an important role in competitive sports, and the achievement motive seems to be especially relevant for athletic peak performance (Gabler, 1995; 2002). Atkinson (1957) and Heckhausen (1963) divide the achievement motive into two components, namely the motive to achieve success and the motive to avoid failure. Several studies have investigated the achievement motive in relation to sports. Thomassen and Halvari (1996) found a significantly positive relationship between the motive hope for success and the amount of competitive training and athletic success, whereas a strongly developed motive fear of failure correlated negatively with athletic success. Gabler (1981) determined that high hope for success and low fear of failure are important prerequisites for keeping up athletic training over a longer period of time. The lower the hope for success and the higher the fear of failure are, the more likely a cessation or reduction of athletic training is. An individual with a dominance of fear of failure over hope for success may choose achievement goals that are either too easy or too hard (Elbe & Wenhold, 2005), and may be more likely to lose motivation, stagnate in their overall development and be less satisfied with their sport (Elliot & Harackiewicz, 1996). The *effort* constraint refers to the ability of an individual to persist in high levels of deliberate practice; this is comparable to the concept of volition, as discussed e.g. in the Rubicon model of action phases (Heckhausen, 1989). This model stresses the assumption that motivation needs to be complemented by volition or will-strength in order for an intention to be transformed into an action. In other words, motivation alone is not sufficient to maintain athletic training over the long period of time required to achieve expertise, but has to be “backed up” with volitional processes. These processes are responsible for initiating an action, despite internal and external resistance, and for maintaining the action until the goal has been reached (Kuhl, 1983). Several studies confirm the significant role that motivational and volitional factors play in the
involvement and performance level of athletes in top-level sports (e.g. Beckmann & Kazén, 1994; Elbe, Beckmann, & Szymanski, 2003; Holt & Dunn, 2004; Van Yperen, 2009). Elbe, Beckmann and Szymanski (2003) showed significant correlations between achievement motivation and not only the current but also the future sport performance in a sample of young elite athletes. Furthermore, Elbe and Wenhold’s (2005) study indicated that competitive athletes scored significantly higher scores on hope for success (achievement motive) than athletes that did not take part in competitions regularly. In Wenhold, Elbe and Beckmann’s (2009) research volitional factors discriminated between elite and near-elite athletes. The elite athletes showed higher scores on the beneficial volitional factors related to goal maintenance and self-control and lower values on the not beneficial factors related to problems with initiating actions and staying focused.

Even though the relationship between practice and performance is one of the most robust in behavioral science (Baker et al. 2005b), criticism arose regarding Ericsson et al.’s (1993) approach. Firstly, even though many studies revealed that elite performers trained more than near-elite performers, the elite performers did not reach the magic number of 10,000 practice hours (Van Rossum, 2000; Baker, Côté, & Abernethy, 2003). Secondly, Baker and Côté (2006) point out that reducing the development of expertise in sport solely to deliberate practice fails to acknowledge important developmental, psychosocial and motivational factors of young athletes. Thirdly, there is no consensus that early onset and early specialization are required for the development of expertise (e.g. Carlson, 1988; Barynina & Vaitsekhovskii, 1992; Lidor & Lavyan, 2002). The results of Vaeyens, Güllich, War and Philippaerts (2009), for example, clearly show that there is no evidence that an early onset and a higher amount of sport-specific training are associated with greater success at a later stage.

Additionally, a body of research emerged showing that early specialization can lead to negative consequences for the athletes, such as attrition and negative health outcomes (e.g. Côté et al., 2007). Law et al. (2007) found that Olympic-level rhythmic gymnasts, who had acquired significantly more training hours in their career, also rated their health as lower and their participation experiences as less fun than that of their peers at the international level. Gould, Udry, Tuffey and Loehr’s (1996) study revealed that early specialization and highly structured training reduced intrinsic motivation and increased likelihood of dropout and burnout among young athletes. Likewise, Wall and Côté (2007) found that ice-hockey players who dropped out began off-ice training earlier than athletes that continued their participation. This indicates that early-specialized training regimes that are not inherently enjoyable can have a detrimental effect on the long-term development of athletic expertise. These results strengthen the assumption that in order to become a highly motivated, self-determined and committed adult athlete, it is crucial to build a solid foundation of intrinsic motivation at early stages (Deci & Ryan, 2000).

No one involved in elite sports will negate deliberate practice as an important pillar for reaching expertise, and the prominence of practice is generally agreed upon in literature (Janelle & Hillman, 2003). However, the risks of an early and intense involvement in sports as well as the evidence for late specializing experts need to be acknowledged. Therefore, it has to be questioned whether or not early specialization is the exclusive path to expertise. It also needs to be investigated if different paths that involve lower risks for the individual, can lead to the same outcome (Baker et al., 2005a).

**Elite Performance Through Early Diversification**

Based on the above-mentioned results, the notion emerged that in addition to early specialization, expertise can also be reached through early diversification (Côté et al., 2007). Two underlying notions exist for this path. From a psycho-social point of view, it can be reasoned that engaging in a variety of different sports allows the young athlete to experience different physical, cognitive, affective, and psycho-social environments (Côté, Lidor, & Hackfort, 2009). It is hypothesized that this path promotes the development of intrinsic motivation (Côté et al., 2007), which again serves as the basis for a self-regulated
involvement in an elite sport at a later stage (Côté et al., 2009). From a performance point of view, it can be hypothesized that experiences in different sports provide the young athlete with important abilities. These abilities prove beneficial in the development of sport-specific skills required to reach elite performance in the main sport at a later stage in one’s career. There is a general assumption that talented athletes can benefit from such a transfer across sports (Williams & Ford, 2008). Baker et al. (2003) support that view, stating that a transfer of learning takes place from one sport to another, including both cognitive and physical abilities. Current research further suggests that the effect of such a transfer is most pronounced during early stages of involvement (Schmidt & Wrisberg, 2000), corresponding with the time frame of the sampling years in the “Developmental Model of Sport Participation” (Côté et al., 2007). Based on these considerations, it can be hypothesized that involvement in different sports, during at least the early stage of the career, might be beneficial for reaching elite performance.

There is evidence that later specialization can be more beneficial while training to become an expert athlete. Carlson (1988) found that elite tennis players specialized later, practiced less than their near-elite peers between the ages of 13 and 15, but intensified their training considerably more after age 15. Likewise, Lidor and Lavyan (2002) found that elite athletes from different sports began specializing later than near-elite athletes. Nevertheless, the elite athletes completed more training hours when they reached peak performance, indicating that despite their late start, they managed to compile enough hours to perform at the top level. Barynina and Vaitsekhovskii (1992) found that swimmers who specialized early spent less time on the national team and ended their sport career earlier than athletes who specialized later. Güllich’s (2007) results showed that early intensification in athletic development does not correlate with long-term success, but that in contrast, particularly successful careers are characterized by a deceleration of practice and competitive development.

Lidor and Lavyan’s result (2002) confirms the idea of sampling, finding that 70% of the elite, compared to 58% of the near-elite athletes, performed more than one sport in their early years of involvement. Likewise, Emrich and Güllich (2005) report that both being active in another sport beside the main sport, and starting one’s sport career in another sport and then switching to the main sport at a later age, is significantly more prevalent in internationally competitive German athletes when compared to their peers that competed only at a national level. Evidence suggests a beneficial effect of early diversification, not only on performance level, but also on other variables. Baker and Côté (2006) state that sampling and deliberate play in the early years of sport participation may lead to more enjoyment and a lower frequency of dropout, which indirectly contributes to the attainment of a high level of performance in adult years. Moreover, they report that athletes who sample and diversify in their young years may be less at risk for injuries than their peers that specialize early.

However, doubts concerning sampling being inherently beneficial for all young athletes arose; several authors questioned whether or not early diversification is applicable to all sports (Baker, 2003; Williams & Ford, 2008), and Côté et al. (2009) conclude that early diversification is not beneficial for athletes’ performance in sports where peak performance occurs before full maturation, such as gymnastics. Emrich and Güllich’s (2005) study also confirms this assumption.

**Sport Specificity in Career Development**

Based on the results above, it is expected that the career paths of athletes from sports with a focus on different capabilities (e.g. physical, technical, tactical) are unique and should therefore be analyzed separately. However, Emrich and Pitsch (1998) propose that sports sharing similar structural conditions will lead to similar career paths, justifying analyzing similar sports together. Other studies also followed that approach, analyzing data of athletes from different sports with similar structural exigencies (e.g. Güllich, 2007; Emrich & Pitsch, 1998). Team sports have similar requirements: athletes often cope with varying
situational conditions caused by the constant changes of opponents’ and teammates’ behavior, resulting in a high variability of training and competitive loads (Güllich, 2007). For team sport athletes, it is necessary to have a highly developed, sport-specific technical skill level, distinctive physical capabilities, good tactical understanding as well as excellent visual and perceptual capabilities. Jointly, it is hypothesized that reaching expertise in team sports requires a high volume training regime in order to develop all the required capabilities. This leads to the assumption that athletes in such sports should start their involvement early in hopes of developing these capabilities before reaching peak performance age. Another assumption is that athletes from team sports benefit from involvement in other sports, as this is believed to lead to a broad, diverse motor development, which fosters creativity (Memmert, Baker, & Bertsch, 2010) and additional visual and perceptual capabilities.

Aim of the Study

The aim of this study is to gather and compare data about the careers of elite and near-elite athletes in team sports. The first step will be to investigate if there are differences between elite and near-elite athletes in the following variables: practice hours in the main sport, involvement in other sports, time point of career start, as well as motivational and volitional factors. The second step aims to analyze if these variables predict membership in the elite group.

Based on the reflections about the team sport category mentioned above, the following hypotheses are formulated:

**H1 – Prediction About Group Differences.** It was expected that due to the complexity of team sports, elite athletes practice more, and this way accumulate more practice hours during their career than their near-elite peers (H1.1). Likewise, as team sports pose high demands on technical and tactical capabilities, and a skill transfer from other sports (at least at a young age, Baker, 2003; Williams & Ford, 2008) can be expected, it is hypothesized that elite athletes have participated in a larger number of sports and have been involved longer in other sports during their career (H1.2). Based on the assumption that elite athletes need to accumulate more practice before reaching expertise, it is hypothesized that they begin their career at an earlier age than their near-elite peers (H1.3). Finally, in order to pursue a dedicated and goal-oriented training regime, it is hypothesized that elite athletes have more beneficial values concerning motivational (H1.4) and volitional variables (H1.5) than near-elite athletes as for example indicated in the Wenhold, Beckmann and Elbe (2009) study. This means that we expect that elite athletes show higher hope for success and lower fear of failure. Further we expect higher scores on volitional scales assessing beneficial factors related to goal maintenance and lower scores on factors relating to problematic aspects of goal maintenance.

**H2 – Assumptions About Prediction of Group Membership.** It is assumed that variables related to accumulated practice hours, engagement in other sports, initiation of career, as well as motivational and volitional variables predict the membership in the elite group.

Method

**Design**

In order to get more information about the optimal path for reaching high-level athletic performance, it seems meaningful to identify how elite and near-elite athletes can be differentiated based on exposure to practice activities (Williams & Ford, 2008). Many studies in the domain of talent development and expertise have been conducted with a retrospective design based on the seminal work of Bloom (1985). Since Bloom’s open-ended interview studies, other study designs have been applied using fixed-response questionnaires (e.g. Helsen, Starkes, & Hodges, 1998; Starkes et al., 1996;) and quantitative
interviews (Côté, Ericsson, & Law, 2005). Common for all of these approaches is that they face methodological risks, namely that athletes cannot recall their past experiences or that the recall of past experiences is biased (see Hodges, Huys, & Starkes, 2007). These risks pertain especially to questions asking about characteristics of past training (e.g. enjoyment, effort; Côté, Ericsson, & Law, 2005). However, Helsen, Starkes and Hodges (1998) and Côté, Ericsson, and Law, (2005) documented that elite athletes can recall objective information like training hours and athletic success fairly reliably both in questionnaires and interviews. This indicates that retrospective studies can provide interesting and meaningful insights into the early experiences of elite and near-elite athletes when the focus is on objective information, and not enough resources for longitudinal studies are available. Based on these considerations, the present study adopts a cross-sectional, retrospective design. In order to economically access a large and geographically widely spread sample and due to the fact that the questions related to objective past experiences a questionnaire design was chosen for this study.

Procedure

A link to a web-based questionnaire was sent out to the target group by email. A web-based design was chosen because it seemed most suitable for a sample involving young persons. Web-based studies offer the advantage that the participants can choose individually when they want to answer and are also a low-cost method for obtaining responses from participants from different parts of the country (Shaugnessy, Zechmeister, & Zechmeister, 2006). Before starting the questionnaire, the athletes were informed about the content and the aim of the research project, were told that all data would be treated confidentially, and that participation was voluntary. According to Danish rules, no further ethical approval is necessary for this study. After six weeks, a re-test was sent out to the participating athletes with the aim of checking the reliability of some of the variables. In order to increase response rates, reminders were sent out by mail and/or SMS after both surveys. To further check the reliability of the data, 16 participants who simultaneously took part in an interview study were on that occasion asked the same questions again, offering the unique opportunity for another reliability check four months after data collection. For this study only the team sport athletes were selected.

Sample

All athletes that were registered in the database of Team Danmark1 and who were either supported in the year of the survey (2009) or had been supported within the last six years were contacted. Data of 91 female and 94 male Danish athletes (N = 185) from team sports with a mean age of 21.51 (SD = 5.29) could be gathered. The total sample involves athletes from soccer (n = 92), handball (n = 45), ice hockey (n = 38), and volleyball (n = 10). The “elite” group (n = 64; 38 females and 26 males; age: M = 23.20, SD = 5.74) included athletes who placed among the top ten at a world-level championship (e.g. World Cup, Olympics) or who won a medal at a championship on a European level (e.g. European Championship) on a senior level. The differentiation between elite and near-elite athletes based on Championships results follows the procedure applied by Emrich, Fröhlich, Klein and Pitsch (2009) and Emrich and Güllich (2005). In order to eliminate an age bias, athletes up to age 21 were also included in the elite group if they stated that they had won a medal at a junior world championship. All athletes who did not meet one of these criteria were consequently labeled as near-elite athletes (n = 121; 53 females and 68 males; age: M = 20.62, SD = 4.83). Near-elite athletes can thus be described as high level athletes competing at international level, without so far having succeeded in ranking top at international championships. Analysis performed on the entire sample of team sport athletes, indicated that the elites were significantly older than the near-elites. In order to eliminate this age bias, which could lead to skewed results, only active athletes were selected for these further analyses. Furthermore, each elite athlete was paired with a near elite athlete of the
same sport, age (+/-12 months) and sex. In the case that there was more than one matching near-elite athlete the athlete closest in age (birth month) and with the lowest number of missing answers was selected. In total 38 pairs (N = 76; 50% males, 50% females) of elite and near-elite athletes could be matched in the entire sample and form the basis of the analyses. Table 1 displays a description of the sports in the final sample.

**Instruments**

The questionnaire gathered information about the following topics:

- **Biographical Information**
- **Practice Hours in the Main Sport.** The athletes had to report how many hours they trained on average per week for every year in their main sport, starting with the current year and then working backwards (Hodges et al., 2007). To cover the definition of deliberate practice in sport in the best possible way (see introduction), they were asked to include all forms of training (technical, physical, mental) in their main sport as well as competitions in this calculation. The accumulated amount of practice hours at age 9, 12, 15, 18 and 21 was calculated based on this question.
- **Involvement in Other Sports.** The athletes were asked to state all additional sports they were involved in during their career by indicating which sport they were engaged in and how many months they practiced in the respective sport. In order to properly address the question of diversification which focuses on additional sport activities in the early stages of a sport career, the additional sports were added if they were started before the age of 15.
- **Career Start.** The athletes had to state at what age they started participation in their main sport.
- **Weekly Training Schedule.** For data validation purposes, the athletes were asked to report their average training schedules for every weekday during the current year or, alternatively, for the last year they were involved in their main sport at an elite level.
- **Athletic Success.** The athletes were asked to state their results at different international competitions at junior and senior levels.

The theoretical basis for including the motivational and volitional factors is the Rubicon model of action phases (Heckhausen, 1989; see introduction). This model shares similarities with the idea of motivation and effort proposed by Ericsson et al. (1993). The following measurement instruments were chosen based on availability of these questionnaires in Danish, as well as good reliability and validity in previous studies:

- **Achievement Motive.** The short version of the Achievement Motives Scale-Sport Danish (Elbe & Wenhold, 2005; Elbe, 2008) assesses the two achievement motive components, *hope for success* and *fear of failure*. Each scale has five items, with a Likert-scale answering format ranging from 0 (*not true for me at all*) to 3 (*exactly true for me*). The values for the scales range from 0 (very low) to 15 (very high). The two scales show high internal consistency with the current sample (*Hope for success: Cronbachs alpha*\(^2\) = .83, *N = 573; Fear of failure: a = .85, N = 573*).
Volition. The Volitional Components Questionnaire Sport (VCQ-Sport; Wenhold et al., 2009) measures volitional skills as well as deficits related to training and competitions. It assesses 60 items through 20 scales within four main components (self-optimization, self-impediment, lack of activation, and loss of focus). The questionnaire has a Likert-scale answering format ranging from 0 (very low, “not true for me at all”) to 3 (very high, “exactly true for me”). The scales are formed by taking the average of all items, resulting in scale values ranging from 0 (very low) to 3 (very high). For the present study, due to the length of the questionnaire, it was decided to focus on the four scales: self-determination (Danish version: 4 items), lack of energy (4), postponing training (3) and avoiding effort (4). These scales were considered particularly meaningful for the research question and showed satisfactory to good psychometric properties in the Danish version (α between .68 and .83; Test-retest reliability between .67 and .70; Wikman, 2007). The scales showed acceptable internal consistencies for the present sample (lack of energy: α = .71, N = 563; postponing training: α = .78, N = 563; avoiding effort: α = .68, N = 563; and self-determination: α = .61, N = 563).

Data Analyses

Missing data presents a challenge in research (Tabachnick & Fidell, 2007). In the present study, due to the required extensive reporting of training hours for all career years a relatively high amount of missing values was expected concerning this question. To reduce the risk for bias, only athletes that filled in data for at least five years of their career, respectively three years for athletes under the age of 20 were included in the analyses regarding the training hours. For these remaining 50 athletes, 87% of the expected data was reported by the athletes. The total number of athletes was included in all other analyses (see also table 1).

To analyze outliers, data of the variables practice hours in main sport and involvement in other sport was z-transformed. Values exceeding a z-value of ±3.29 (see Tabachnick & Fidell, 2007) were listed and analyzed separately. For all variables including outliers, a cut-off was set that was based on the raw value of the first outlying value as well as foundations of the author team. All outliers were then adapted to this value (i.e. values exceeding 50 hours of training per week for athletes above 20 years were set to 50).

After gathering data from the main survey and the two re-tests, correlations were performed to analyze the reliability of the data on practice hours in the main sport. This was done as retrospective data can be biased, and checking the data before analyzing seems indispensable.

In order to investigate differences between the elite and the near-elite sample, in terms of the variables related to practice hours in the main sport, involvement in other sports, data on career development, as well as motivational and volitional factors, one-tailed t-tests were conducted. The significance level was set at ≤.0.05. Furthermore, the effect sizes were analyzed to judge for meaningfulness and power values were calculated.

A logistic regression was performed to investigate if practice hours in the main sport, involvement in other sports, data on career start, as well as motivational and volitional factors (IVs) predicted membership in the elite athlete group (DV). The enter method was chosen, as this seemed most suitable since there are no hypotheses about the order of importance of predictor variables. Assumptions regarding the distribution of the predictor variables are not required for logistic regressions (Tabachnick & Fidell, 2007).

Due to the equal distribution of males and females in the elite and near-elite group no gender specific evaluations were performed.
Results

Reliability of the Data

Checking the reliability of the reported practice hours during the career occurred with three different measures. 1) A correlation between two measures given in separate sections of the questionnaire was performed, both aimed at gathering the same information (e.g. the amount of weekly training in the data on practice hours history and the information about the average training amount per week from the same year). The correlation between these two measures was .70 ($N = 459$). 2) The average result of the written re-test (4 weeks after the data collection) over the seven different time points was .75 for the weekly training amount. 3) The results of the re-test gathered during the interview study with 16 athletes (4 months after the data collection) showed a correlation of .74 for the weekly training amount. All correlations can be categorized as strong (Brace, Kemp, & Sneglar, 2009). Additionally, analyses revealed that the correlations in the elite and the near-elite athletes (elite athletes: .76, near-elite athletes: .74) did not differ, indicating that the two groups had a similar level of recall.

Group Differences

T-tests reveal significant differences between the elite and near-elite athletes in 3 of 14 variables (table 2). The results show that elite athletes start their sport career significantly later ($M = 6.45$, $SD = 2.83$) than their near-elite peers ($M = 5.45$, $SD = 2.46$; $t = -1.65$, $df = 74$, $p = .05$). The result is confirmed by a small to moderate effect size (0.38; Cohen, 1969) All other variables regarding accumulated practice hours in the main sport and involvement in other sports show no significant group differences.

Table 2. Comparison Between the Elite and the Near-elite Group on Data About Accumulated Practice Hours, Involvement in Other Sports, Career Development, Motivation and Volition (Means, Standard Deviation, Mean Differences and Effect Sizes)

|                                            | Elite       | Near-elite  | $t$  | $df$ | $p$  | $|d|$ | Power |
|--------------------------------------------|-------------|-------------|------|------|------|------|-------|
| Accumulated Practice hours up to age 9    | 24 763.75   | 26 956.00   | 0.89 | 48   | .19  | 0.25 | 0.50  |
| Accumulated practice hours up to age 12   | 24 1688.90  | 26 1984.00  | 0.70 | 48   | .24  | 0.20 | 0.50  |
| Accumulated practice hours up to age 15   | 24 3547.90  | 26 3525.00  | -0.04| 48   | .49  | 0.01 | 0.50  |
| Accumulated practice hours up to age 18   | 24 5925.80  | 26 5903.00  | -0.03| 48   | .49  | 0.00 | 0.49  |
| Months of involvement in other sports     | 38 70.89    | 38 58.82    | -0.71| 74   | .22  | 0.18 | 0.50  |
| Entering sport                            | 38 6.45     | 38 5.45     | -1.65| 74   | .05  | 0.38 | 0.50  |
| AMS–hope for success                      | 38 10.89    | 38 10.21    | -1.07| 74   | .14  | 0.24 | 0.48  |
| AMS–fear of failure                       | 38 3.37     | 38 2.95     | -0.76| 74   | .22  | 0.17 | 0.49  |
| VCQ–self-determination                    | 37 2.76     | 36 2.60     | -1.77| 71   | <.05 | 0.42 | 0.51  |
| VCQ–avoiding effort                       | 37 0.47     | 36 0.58     | 1.05 | 71   | .15  | 0.23 | 0.48  |
| VCQ–lack of energy                        | 37 0.73     | 36 0.89     | 1.28 | 71   | .10  | 0.30 | 0.50  |
| VCQ–postponing training                   | 37 0.26     | 36 0.50     | 1.85 | 71   | <.05 | 0.43 | 0.50  |
Table 3. Results of the Logistic Regression with Data on Practice Hours, Involvement in Other Sports, Career Development and Motivation and Volition as Predictor and Athletic Success as Dependent Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>p</th>
<th>Exp(B)</th>
<th>Confidence Interval</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated practice hours up to age 15</td>
<td>0.001</td>
<td>0.001</td>
<td>5.30</td>
<td>1</td>
<td>.02</td>
<td>1.001</td>
<td>1.00a</td>
<td>1.002</td>
<td></td>
</tr>
<tr>
<td>Accumulated practice hours up to age 12</td>
<td>-0.002</td>
<td>0.001</td>
<td>5.04</td>
<td>1</td>
<td>.03</td>
<td>0.998</td>
<td>0.997</td>
<td>1.001</td>
<td></td>
</tr>
<tr>
<td>Entering Initiation stage</td>
<td>0.110</td>
<td>0.120</td>
<td>0.80</td>
<td>1</td>
<td>.37</td>
<td>1.113</td>
<td>0.880</td>
<td>1.410</td>
<td></td>
</tr>
</tbody>
</table>

Note. a These values have been rounded to 1.00, but do reflect a significant result and no confidence interval includes the exact number of 1.00.

The data on motivational and volitional factors revealed significant group differences on the volitional scales, self-determination and postponing training, with effect sizes that can be considered close to medium (0.42 and 0.43, respectively; Cohen, 1969). Elite athletes show higher values concerning self-determination (M = 2.76, SD = 0.33) and lower values concerning postponing training (M = 0.26, SD = 0.47) than the near-elite athletes (M = 2.60, SD = 0.43, and M = 0.50, SD = 0.63 respectively).

**Prediction of Group Membership**

In a first step of logistic regressions three variables (accumulated practice hours up to age 15, accumulated practice hours up to age 12, entering sport) were significant and were re-entered in a second logistic regression. The full model of this second analysis significantly predicted membership in the elite group $\chi^2 = 8.11, df = 3, p < .05$). The model accounts for between 15% and 20% of the variance of the membership in the elite group. Overall, 62% of group predictions are accurate. Table 3 illustrates coefficients, the Wald statistics, associated degrees of freedom, probability values, as well as a confidence interval for each predictor variable. The coefficients reveal that a lower amount of accumulated practice hours at age 12, and a higher amount of practice hours at age 15 significantly predict international success. The remaining variables regarding accumulated practice hours in the main sport and regarding volition, as well as variables measuring involvement in other sports, and the achievement motive, do not significantly predict membership in the elite group.

**Discussion**

Investigating the career development of Danish elite and near-elite athletes in team sports has provided rather unexpected results. By rejecting hypothesis H1.1, H1.2, H1.4, and partly H1.5, it can be shown that the career paths in terms of accumulated practice hours, involvement in other sports, as well as motivational factors do not differ between the two groups. The only differences between the elite and the near-elite athletes are that elite athletes start their career later than their near-elite peers (thereby rejecting H1.3), and that elite athletes have more beneficial values on the volitional scales self-determination and postponing training (thereby partly confirming H1.5). The results further revealed that having accumulated fewer training hours up to age 12, and having accumulated more training hours up to age 15 significantly predict the membership in the elite group. This result partially supports hypothesis H2.
Contrary to the predictions of Ericsson et al. (1993), the elite athletes of the current study do not accumulate significantly more practice hours during their career than their near-elite peers. However, even though a whole body of research confirms the positive relationship between practice hours and expertise level (e.g. Baker et al., 2005a; Ericsson et al., 1993; Hodges et al., 2004; Law et al., 2007), a closer look at team sport athletes reveals some controversies in the current state of the art. Some studies indeed confirm the above mentioned positive relationship, stating that elite team sport athletes train more, and therefore sample more practice hours during their career (Emrich & Pitsch, 1998; Helsen et al., 1998; Baker et al., 2003). However, Helsen et al.'s results for field hockey, in contrast with the above mentioned results for soccer players, are more similar to the present findings. The authors also found a main effect for skill and years into career for the field hockey players for all three groups. However, the difference between international and national players did not reach significance within the studied time frame of 18 years upwards in the career, even though the international players did train slightly more from 15 years upwards in their career. Güllich (2007) found that the more successful team sport athletes, between the ages of 15 and 18, practice less in their main sport than their less successful peers.

It cannot be claimed that more practice simply leads to better performance in team sports. Starkes (2000) hypothesized that the absolute amount of practice might not be predictive of team athletes' individual performance, as a certain part of the practice is normally adapted to the skills of the best or worst player on the team, which might not correspond to each player's optimal practice level. Another reason for such equivocal results could be that the range of accumulated practice hours is highly variable, both within and between different team sports, suggesting factors besides total hours of practice that may influence expert attainment in team sports (Baker et al., 2003). Additionally, focusing solely on hours of practice without accounting for content and quality of practice, does not seem sufficient (Janelle & Hillman, 2003; Van Rossum, 2009), and could partially explain the equivocal results found so far. Helsen et al. (1998), for example, suggest that team and individual practice might have different effects on performance. Supporting that view, Ward et al. (2004) summarized that team practice and practice with others were often more accurate predictors of attained performance level. Also, Ward, Hodges, Starkes, & Williams (2007) found that team practice was the most important discriminator between elite and near-elite athletes. Concerning quality of practice, it has to be questioned whether or not all practice hours stated by the athletes should be counted as what Ericsson et al. (1993) call deliberate practice. Deliberate practice is a form of highly goal oriented practice that aims at maximizing improvement. However, to investigate questions dealing with the quality and content of practice, different methodological approaches (e.g. in-depth interviews, longitudinal design) must be adopted, as it can be assumed that such information is difficult to recall after several career years.

The assumption that early onset and early specialization are needed in order to excel in team sports, as suggested in the “elite performance through early specialization” path in the “Developmental Model of Sport Participation” (Côté et al., 2007), cannot be supported by the data of the current study. The elite athletes start later than their near-elite peers, and fewer training hours at age 12 significantly predicts membership in the elite group. These two results are in contrast to the concept of early specialization. These results can be seen in line with Güllich (2007) who reports a lower number of elite players who had already been competing in their main sport between age 11 and 14, showing tendencies that late specialization was more beneficial in his sample. Baker et al., (2003) conclude that early specialization may not be a necessary requirement for expert level performance in decision making sports (such as team sports).

Surprisingly, with regard to the demands that are placed on team athletes, no significant results emerged from the variables concerning involvement in other sports. Sampling different sport experiences, as suggested to be one factor in the “elite performance
through sampling” path (Côté et al., 2007), does not differ among elite and near-elite athletes. This is in line with Ward et al.’s (2007) study which found that athletic diversity did not differ among elite and near-elite soccer players. In contrast, the results of Güllic (2007) revealed that there is a higher number of athletes among the successful team sport athletes who have been practicing consistently in another sport beside the main sport, and did so until the end of their junior years. The accumulated time practiced in other sports is twice as high as that of less successful players. It seems that, even when it comes to the impact of the engagement in other sports on elite performance in team sports, no clear conclusions can be drawn so far.

The present study revealed no significant results regarding the sport specific achievement motive. This is surprising, as motivation is discussed as one core constraint in Ericsson et al.’s (1993) approach, and the sport specific achievement motive has shown to predict athletic success in a sample of young elite athletes (Elbe et al, 2003). In line with this, Reilly, Williams, Nevill and Franks (2000) conclude that motivational orientation is the most important indicator of talent in soccer. Likewise, Holt and Dunn (2004) and Van Yperen (2009) confirm that factors such as commitment and discipline form core competencies for team sport athletes who want to reach expertise. However, at the adult level, a high achievement motive is taken as a given and no longer differentiates between the two very similar groups in our study. More important seem to be volitional skills which support the achievement motive. Partially supporting this are the results of the present study, which reveal the importance of specific volitional factors, namely high values of self-determination and low values in postponing training. Looking at data from individual sports where the individual's performance is immediately visible and athletes never have the opportunity to hide, none of the volitional variables predict membership in the elite group, nor do significant group differences exist (Moesch, Elbe, Hauge, & Wikman, 2011).

To summarize, the findings of the present study reveal that the career paths of elite and near-elite team sport athletes show more similarities than differences. Differences between these two groups of athletes explaining why one group is more successful in international competitions are small in number. One strength of the current study is its design with matching elite with near-elite athletes that share the same socio-demographic characteristics. However, some limitations must be considered when making inferences.

1) The use of retrospective data collection, often considered as prone to error in recall (e.g. Hodges et al., 2007), could have led to distorted data. However, retrospective investigations will remain the main source of information about the acquisition of high elite performance as long as it is not possible to accurately foresee which athletes will succeed on their way to the top (Côté, Ericsson, & Law, 2005). In order to check for biases, several steps to validate the data were taken. The data revealed satisfying results, comparable with those from other studies (Helsen et al., 1998; Hodges et al., 2004). Additionally, Côté et al. (2005, p. 16) concluded, that “athletes were able to accurately recall many aspects of their development even after decades had elapsed.” It can be hypothesized that training activities played such an important part in the athletes’ lives that they recall accurate numbers. 2) It has to be considered that due to the cross-sectional design of the study, conclusions cannot be made about the causal effect of practice. To address that flaw, longitudinal studies have to be conducted. This also applies to the results concerning the volitional factors, which develop during youth (Elbe, Szymanski, & Beckmann, 2005). No conclusions can be made on whether the decisive volitional factors were pronounced at the beginning of the career or were developed during involvement in elite sports. 3) No information about the content of practice was gathered for the present study and different types of training (e.g. physical, mental, competitions) were combined in one question. Therefore, conclusions cannot be drawn about the importance of play-like training activities (e.g. deliberate play; Côté et al., 2007) or about the importance of different forms of training activities (e.g. solitary vs. group practice; Ericsson, 2003; see above). 4) Likewise, no information about the quality of training is available (see above).
Conclusions
The findings of the present study reveal that the career paths of elite and near-elite athletes show few differences. It seems that a later start and a later intensification of training are beneficial in order to make it to the elite group. Furthermore, elite athletes show more beneficial volitional skills than their near-elite peers. However, many variables did not reveal any significant results. It can be assumed that the high level of the athletes of both groups makes it difficult to detect clearer results in the studied variables and that possibly other factors besides the ones investigated in this study make the difference between these two groups.

Acknowledgement
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Reference Notes
1 Team Danmark is the organ that handles overall planning of elite sports in Denmark through financial and instrumental support to sport-specific federations and athletes. Support is given to the sport federations, who in turn decide which athletes they want to support. This support is strategic, i.e. mainly based on the sport federation’s evaluation of the athlete’s potential to win medals in international competitions.

2 The Cronbach’s alpha are based on the analyses of the complete sample of the project, involving the sample from team sports as well as athletes from other sport categories.

References


Kuhl, J. (1983). Motivation, Konflikt und...

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Searching the Information Maze for Giftedness Using the Pearl Harvesting Information Retrieval Methodological Framework

Robert W. Sandieson 1* and Sarah M. McIsaac 2

Abstract: The digital era has brought access to a wealth of information on the topic of giftedness. However, along with an apparent ease of use associated with online databases is the difficulty of finding relevant information from amongst the mass of non-relevant information. Existing information search strategies are limited and the area of giftedness is prone to search deficiencies partly due to the variation of possible search terms. The Pearl Harvesting Information Retrieval Framework addresses the complexities of searching comprehensively in contemporary databases. It was further refined here for searching in the area of giftedness. Using this framework, fifty-three harvested search terms denoting giftedness served as a search strategy. This wide range of search terms located a greater number of relevant citations than other search strategies.

Keywords: gifted, talented, keywords, search filters, information retrieval, information searching

The goal of the present investigation was to create a comprehensive search strategy of the research literature for the topic of giftedness. Such a strategy would empower anyone seeking an overview of the field of giftedness or searching for something very specific which might be difficult to find amidst the volumes of information available in online sources.

In this paper we discuss why being able to efficiently locate information on the topic of giftedness is important, why searching research databases in general is difficult, and how the topic of giftedness is susceptible to difficulties in conducting a comprehensive search. We will describe the Pearl Harvesting Information Retrieval Methodological Framework (Sandieson, 2006; Sandieson, Kirkpatrick, Sandieson, & Zimmerman, 2010) and examine it as a way to map out and test a comprehensive search strategy in this area. This framework, demonstrated for other topics, was further developed and verified here for giftedness.

It is important to know how to perform a comprehensive search of the literature on giftedness for several reasons. First, evidence-informed policy and practice in education, now mandated in some countries, e.g., USA No Child Left Behind (NCLB, 2003), is paramount in making informed, accountable decisions. Evidence-informed policy and practice requires finding as many research studies as possible so decisions rely on the most complete information available. Failure to locate relevant studies jeopardizes the validity of any decision. The field of giftedness does not have as large a research base as some other areas of exceptionalities, and information exists across many journals and databases. For example, Dai, Swanson, and Cheng (2011) note that the field of giftedness lacks the organization of other academic disciplines. It, therefore, becomes critical to have the most effective information retrieval strategy to find what is available on different views from a wide variety of sources.

Knowledge awareness in the area of giftedness is another important reason for being able to search for information comprehensively. This includes anecdotal, theoretical or

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evidence-based information (Callahan & Moon, 2007). The research in the field of giftedness, other than a few areas, covers a wide range of topics rather than a few well-developed ones (Lawrence, 2009; Van Tassel-Baska, 2006). A comprehensive understanding of the area then requires a comprehensive literature search strategy to gather information and enhance awareness of an overview of the diversity of the topics. Finally, if the search intent is to locate information on a specific topic in the area of giftedness (e.g., interventions or behavioral issues of gifted individuals), it is important to be able to search comprehensively, gathering the largest base of studies on giftedness to provide the maximum number of articles on a specific topic.

**Present Problems Searching Online Databases**

Online databases provide the preferred source of research information for many students, academics, and researchers (Hemminger, Lu, Vaughan, & Adams, 2007; Nicholas, Williams, Rowlands, Hamid, & Jamali, 2010). There is an apparent simplicity and convenience to using online databases. However, performing a comprehensive search using research databases is not as easy at it may appear: information today is cumulating at such a rapid pace that a serious problem arises when trying to find relevant information out of the massive volume of non-relevant information (Ge, 2010; Vakkari & Talja, 2006). Borgman (2007) noted that researchers developed their strategies for locating information when databases were first created. Since then, researchers have not changed their strategies in response to the volumes and diversity of information available. What we see now is a complex, often poorly organized information system that appears very much like a complex maze to many users.

Part of the difficulty in doing a comprehensive literature search using online databases is the lack of organizational structure. Databases index information along a number of fields, such as author(s), title, abstract, journal name and subject headings. Database indexers assign subject headings (also referred to as descriptors or identifiers) to each article using a predefined list of topic terms. However, researchers may refer to specific topics in a number of ways and the subject headings may not always include the range of possible terms used as information access points (Arendt, 2006; Sandieson et al., 2010).

The other difficulty in performing a literature search in online databases is that recommended procedures for searching are a hodge-podge of strategies, each with assumptions that are questionable in terms searching comprehensively. White (1994; 2009) summarized the strategies currently used for information searching, particularly for systematic reviews of the literature. The first strategy is reference or citation tracking; backward and forward. Backward tracking, also referred to as ancestral searching, involves reviewing a relevant article’s references to see if there are further related relevant articles. The process continues following connected subsequent articles investigating their references. Forward tracking involves noting studies that cite an original article.

A problem with reference tracking, relative to comprehensive searching, pertains to the underlying assumption that the articles in a body of literature connect through the references. Authors, however, may not cite certain bodies of research if those works use a different paradigm, theory, or research methodology. The assumed association between articles’ references may sometimes be non-existent. Therefore, distinct bodies of research on the same topic may be overlooked using this strategy.

Keyword searching is another search strategy (White, 1994; 2009), which is becoming the norm for literature searching (Holman, 2011; Nicholas et al., 2010; Vakkari & Talja, 2006). Pearl Growing is a recommended approach to locating keywords (Hawkins & Wagers, 1982; Schlosser, Wendt, Bhavnani, Nail-Chiwetalu, 2006). It involves finding a relevant article (i.e., a “pearl”) and then looking for potential keywords in the article’s bibliographic information, e.g., subject headings or descriptors. Newfound keywords initiate new searches, further keywords located in bibliographic information in any further
articles become noted, and the process of keyword extraction and further searching continues until no further keywords exist.

Beall (2008) criticized keyword searching arguing that there are too many ways to linguistically represent a single concept or topic, therefore a possibility always exists of overlooking articles. Furthermore, many information seekers do not appreciate the complexities of the possible synonyms and do not explore the range of options available for multiple keyword searching (Beall, 2011). Another problem for Pearl Growing relates to the same criticism of reference tracking. The assumption here relies on a connection through the keywords. However, if authors use vocabulary that reflects their own theoretical or methodological point of view, they may not use the language of other authors with different points of view. Therefore, the assumed association through terminology may not be present.

Another strategy of searching for information is browsing through indexes of relevant or key journals. While the possibility exists that browsing may uncover articles otherwise missed, there are some inherent problems with this strategy. First, there is no standard theory or methodology for determining key journals. This could result in the omission of specific journals, creating the possibility of overlooking relevant studies. Second, it is possible that studies on a topic do not get published in journals that are amongst the key journals of a field. Cross disciplinary work, in particular, is an example. Another problem with browsing is reviewing a large number of journal indexes lends the process prone to human error. When individuals have to spend numerous hours meticulously scanning text, omission of relevant articles is likely.

It is understandable, then, that even academics and researchers do not always do a good job of searching (Jankowska, 2004). Haglund and Olsson (2008) report that young researchers rely extensively on Google without much planning for their searches. More alarming is that they perceive themselves as competent.

Systematic reviews of the literature (including meta-analyses) rely on high quality comprehensive searching so their syntheses include as much information as possible. Arent (2007) reviewed meta-analyses in APA journals conducted in 2004. She found that of the 23 studies documenting their information searching protocols, 78% did not include search terms that were available in the database thesauri. She also found that 57% of studies that reported on their search protocols used search terms not available in the thesauri. Valentine, Cooper, Patall, Tyson, and Robinson (2010) reviewed ten meta-analyses on after-school programs and found great disparity of search terms used. In some cases, studies used completely different search terms for the same topic. Sandieson et al. (2010) reviewed a study that collected meta-analyses in the area of intellectual disabilities and found that 43% more meta-analyses could be found than the original published collection. Minor and Raju (2004) reviewed a published meta-analysis on risk taking and found that a better search strategy and inclusion of added studies contradicted the results from the original analysis. These studies provide evidence that conducting a comprehensive review of the literature can indeed be a challenging task even for the most diligent researchers who rely on currently recommended information retrieval strategies.

**Information Retrieval and Giftedness**

There is no single standard definition of giftedness at present (Cohen, 2006; Renzulli, 2002). Although a significantly above norm Intelligence Quotient was once the standard definition, other diverse manifestations of high level functioning now exist. These include concepts and measures such as specific talents, high academic achievement, and high aptitude test scores. Even though there is no current consensus on what constitutes giftedness, the discussion is lively and ultimately may lead to a synthesis that takes into account the wide varieties of superior functioning.

A difficult information retrieval problem emanates out of this diversity of views on
giftedness, however. That is, what are all the linguistic representations of the variety of points of view? The point here is that the terminology functions as keyword search terms so it is important to know all the linguistic representations.

To deal with the issue of diverse ideas on giftedness, and corresponding terminology variation, the present investigation tested the hypothesis that there is a large set of terms to denote giftedness. If located, verified and then used in combination as a comprehensive literature search strategy, this set of search terms would be valuable in developing a large pool of relevant citations on giftedness located in research databases. The rationale and methodology for this hypothesis emanated from the Pearl Harvesting Information Retrieval Framework. A description of this framework and its application to the topic of giftedness follow.

The Pearl Harvesting Information Retrieval Framework

The present investigation sought to further develop and test the Pearl Harvesting Information Retrieval Framework (Sandieson, 2006; Sandieson et al., 2010) as a way of locating the greatest number of articles possible on the topic of giftedness. The rationale of Pearl Harvesting is that terminology on a topic originates from a wide variety of authors and indexers. The variety of terms results from factors, such as time, culture, geography, research paradigm, and research methodology.

Pearl Harvesting’s methodology derives from the concept of probability sampling. The premise is that at any one moment there is a population of relevant search terms that represent a topic and therefore the complete set of these terms become the access point to locate a comprehensive collection of articles on that topic. A set of topic related search terms constitutes a synonym cluster. The difficulty in locating these terms is that it cannot be known a priori what all the terms are or where they are found. The Pearl Harvesting procedure deals with this uncertainty by locating a synonym cluster through sampling a representative body of text sources that contain information on the topic under consideration. An analysis of these sources uncovers potential search terms. In the few studies conducted, the sampling procedure for Pearl Harvesting used reference lists found in collections of meta-analyses or all studies on a specific taken topic from a journal representative of the field. Each study used for analysis served as a pearl, analyzed for its use of relevant terminology. Where Pearl Growing uses one article or pearl as a starting point for locating terms, Pearl Harvesting uses multiple pearls, i.e., a “string of pearls.”

The next step in the Pearl Harvesting method is to locate the string of pearls in online databases, such as ERIC and PsycINFO, and review the bibliographic information of the articles, i.e., the title and abstract (where terminology is used by the authors), for potential search terms. Also of importance are the subject headings/descriptors/identifiers. These are the terminological gateways chosen by database indexers from the predefined vocabulary of the database (found in the database thesaurus).

Analysis of terms (or phrases) is done manually rather than trying to use computer analysis of individual words and their frequency. The reason for this is that an important component of search terminology exists at the level of phrases. Computers can parse individual words easily but are not efficient in analyzing novel phrases for semantic relevance (Beall, 2011).

The chance of overlooking possible relevant terms exists with Pearl Harvesting, as would be the case with any sampling procedure. At this point in development of the framework there is no guide to knowing how many sources to sample. Therefore, extra validation ensures the identification of as many relevant search terms as possible. Comparisons are done with other sources, such as topic related systematic reviews, to see if other researchers used alternate search terms with their information retrieval strategy. Any further terms located contribute to the potential list in the synonym cluster.

Once located, the synonym cluster of potential search terms undergoes a Boolean subtraction procedure to establish the necessity of each search term (using the Boolean
NOT function provided by databases). That is, if a search term yields relevant citations that the combination of all other possible search terms in the cluster would not identify, then that term is unique and essential to the cluster. For example, with potential search terms A, B, C, and D, does the search term A produce any unique relevant citations? Subtracting all the citations found by searching with the terms B, C, and D, from the number of citations found by searching with term A determines uniqueness; that is, A NOT (B OR C OR D). Reviewing the citations to see if they conform to the definition of topic determines relevancy. This procedure is done with every search term to validate its necessity in the synonym cluster.

A final test of the Pearl Harvesting synonym cluster is to compare it in relation to other search strategies to see if it can retrieve more unique and relevant citations. This answers the question is there a benefit to the time and effort to collect all the search terms?

**Finding a set of search terms for giftedness**

Our initial exploration of the field of giftedness did not find the broad range of systematic reviews as other areas of research with exceptional children. Therefore, it was thought that systematic reviews here were not representative enough of the field giftedness. We investigated an alternative source of a representative body of work; the reference lists from a collection of book chapters in a handbook on giftedness (Handbook of Gifted Education, 2nd Edition, Colango & Davis, 2003). The eight chapters that dealt with definitional issues provided a cross section of different authors surveying the concept of giftedness.

A total of 79 journal articles formed the string of pearls. As located in the ERIC and PsycINFO databases, their bibliographic information in the title, abstract, and descriptors yielded possible search terms. These two databases were employed because of their common use amongst researchers, and their focus on educational and psychological topics. Any systematic search for articles on giftedness would require numerous databases beyond the two chosen here. However, these two served as a starting point for the collection of the synonym cluster. In terms of developing the search terms, the truncation function allowed for multiple versions of the same stem term, e.g., “high* intell*” refers to both “highly intelligent” and “high intelligence”. One term not included here was creativity. The reason for its exclusion was a practical consideration. That is, this term appeared to have quite a few variants and it was felt it warranted its own investigation thorough separate analysis; making it beyond the scope of the present investigation.

**Verification of search terms.**

Search terms employed by systematic reviews provided an external source of verification in comparison to the ones found through Pearl Harvesting since systematic reviews require high quality information retrieval. The giftedness Pearl Harvested synonym cluster of search terms found at this point served as a search string in PsycINFO and ERIC in combination with the synonym cluster: meta-analysis, “meta analysis”, “research synthesis”, “systematic review”, “integrative review” and “realist synthesis”. Since the gifted synonym cluster pertained to citations in just these two databases, these databases were the ones used here. This produced thirteen recent systematic reviews after 1990 where giftedness in some form was documented as a search term (see table 1). There were ten search terms found in the systematic reviews not previously located through Pearl Harvesting sampling: high achieve*, accelerated learner*, accelerated student*, able learner*, able student*, superior learner*, superior student*, advanced student*, advanced placement program*, advanced placement course*. These contributed to the potential Pearl Harvested synonym cluster (see table 2). We conducted a further search with the new terms attempting to locate further systematic reviews for the verification process but it did not yield any more.
<table>
<thead>
<tr>
<th>Author</th>
<th>Article title</th>
<th>Journal</th>
<th>Search terms</th>
<th>Databases</th>
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<tbody>
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<td>Coleman, L. J., Guo, A., &amp;</td>
<td>The state of qualitative research in gifted education as published in</td>
<td>Gifted Child Quarterly</td>
<td>gifted, talented</td>
<td>not specified</td>
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<td>for gifted students</td>
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<td>creative contribution types and eminence</td>
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<td>epidemiologic literature</td>
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<td>Miller, K. &amp; Cummings, G.</td>
<td>Gifted and talented students' career aspirations and influences: A systematic</td>
<td>International Journal of Nursing</td>
<td>gifted high school students</td>
<td>CINAHL, ERIC, PsycINFO, ABI, EMBASE, HealthSTAR, Academic Search</td>
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<td>Cooperative learning with gifted and high-achieving students: A review and</td>
<td>High Ability Studies</td>
<td>gifted students, high ability, high achievers, high achievement</td>
<td>PsycINFO</td>
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<td>Steenbergen-Hu, S. S. &amp;</td>
<td>The effects of acceleration on high-ability learners: A meta-analysis</td>
<td>Gifted Child Quarterly</td>
<td>gifted/talented, high ability, high achievement/achiever, accelerated/able</td>
<td>PsycINFO</td>
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<td></td>
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<td>programs</td>
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<td>Vaugh, V. L., Feldhusen, J.</td>
<td>Meta-analysis and review of pull-out programs in gifted education</td>
<td>Gifted Child Quarterly</td>
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<td>Hodge, K. A., &amp; Bowes, J. M.</td>
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<td>(2012)</td>
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Table 1. Information Retrieval Search Terms Used by Systematic Reviews on Giftedness
## Table 2. Unique Citations and Percent Relevant of Potential Giftedness Search Terms (Peer Reviewed Only)

<table>
<thead>
<tr>
<th>Potential search terms</th>
<th>ERIC unique citations</th>
<th>ERIC unique, relevant citations (percent)</th>
<th>ERIC estimated total # of unique, relevant citations for synonym cluster terms</th>
<th>PsycINFO unique citations</th>
<th>PsycINFO unique, relevant citations (percent)</th>
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**Pearl Harvested synonym cluster**

| 7525 | 9001 |
Verification of uniqueness and relevance of search terms.

The next step determined whether all the search terms in the synonym cluster were unique and relevant to the topic giftedness. Table 2 documents the number of unique citations found for each term using the Boolean subtraction procedure (only peer reviewed citations were included here). A citation was relevant if it pertained to giftedness. The intent of the present investigation was not to judge which definition of giftedness was appropriate, but merely to acknowledge the widest range of possibilities. Therefore, any discussion in an article about above norm functioning resulted in an article being relevant. Sampling for relevancy occurred when the number of citations retrieved for a search term exceeded 150; choosing the first, middle, and last 50 citations. In the case of gifted*, the first, middle, and last 100 citations represented the population of citations because of the large number retrieved. Inter-rater reliability between the first author and a graduate research assistant on a random selection of 500 citations showed no discrepancy for relevancy.

Results

Fifty-three search terms produced unique and relevant citations pertaining to giftedness (see table 2). On an individual term basis, the number of citations retrieved by the term gifted* is notable. It located over 5000 citations in both ERIC and PsycINFO, whereas the next highest number of citations found by a single term was less than 1000 in both databases. An interesting finding with the term gifted was that the term giftedness retrieved a small number of extra citations demonstrating the need to use the truncation function, i.e., gifted*, rather than just gifted.

Two terms produced a low percent of relevant citations; prodigy and precocious. In the case of prodigy, the conflict originated in the reference to "Prodigy©," an online computer service. The term precocious identified an adjective often relating to child and youth development, such as precocious social or physiological development (e.g., precocious sexual activity) without any reference to above norm functioning in the sense of giftedness.

In the case of prodigy, the number of retrieved citations was small, requiring no further action. For precocious, there were a large number of citations particularly in PsycINFO, so a method referred to in computational linguistics as word sense disambiguation (e.g., Turdakov, 2010) ensured more precise searching here. This involved looking at the context of the wording of precocious in the bibliographic information, particularly the abstract, and noting if there are any combinations of associated words that might provide a more precise search. For example, the phrases "precocious child*" and "precocious reader*" retrieved citations with 100% relevancy. Table 2 documents the list of associated, more precise precocious search terms.

A number of potential search terms related to intervention programming and giftedness. In most cases the Boolean subtraction procedure demonstrated these terms did not yield unique citations. There were exceptions, however; advanced placement program*/course* and enrichment program*/course* which yielded unique relevant citations.

Another interesting finding was the information retrieval difference between the ERIC and the PsycINFO databases. The overall number of relevant citations was equivalent in both, however, the search terms other than gifted* retrieved a larger number of citations in PsycINFO versus ERIC.

The following search terms comprised the Pearl Harvested synonym cluster for giftedness; presented in a format for copying and pasting into a single search field of a research database. Google Scholar, however, does not accept more than 32 search terms at one time, so the listing here allows a searcher to investigate terms in their rank order of frequency as determined in table 2.
Benefit of a synonym cluster.

The predicted beneficial hypothesis of the Pearl Harvested synonym cluster was its ability to locate an extensive number of relevant citations. Two alternate search strategies comprised a test of this hypothesis.

The first alternate strategy involved using the search term gifted itself. This is a common search strategy as found in the list of recent meta-analyses (see table 1). The term gifted also accounts for the majority of citations in both the ERIC and PsycINFO databases so it is a robust search strategy. The question was how many more unique, relevant citations did the Pearl Harvested synonym cluster retrieve?

The calculation for the total number of citations found by the synonym cluster involved summing the number of unique, relevant citations found by each term in the cluster. For terms with relevancy estimations, the calculation involved taking the total number of unique citations for that term and multiplying by the percent relevant.

The estimated total for the synonym cluster in ERIC was 7525; and 9001 for PsycINFO. The estimated total for gifted was 4715 in ERIC and 3664 in PsycINFO. The Pearl Harvested synonym cluster then added 2810 citations beyond searching with just the search term gifted in ERIC (a 60% increase) and added 5337 citations in PsycINFO (a 146% increase).

A second comparison used the list of search terms gathered from all the systematic reviews of the literature in table 2. We used the truncation function rather than the specific terms used in the meta-analyses since they did not capture such nuances as plurals. In fact, it is interesting to note by looking at the search terms used in the systematic reviews that they often did not make full use of the truncation function and did not report using parentheses for phrases. These two simple search techniques gather more citations and provide for greater precision in searching. The list of terms gathered from the systematic reviews was: gifted OR talented child* OR talented student* OR advanced placement course* OR academically talented OR intellectually superior OR high abilit* OR high achieve* OR able learner* OR accelerated learner* OR high IQ OR superior learner OR genius. All phrases employed parentheses here for greater precision. Such an approach to collecting search terms might also serve as a quicker way to locate a synonym cluster rather than the detailed procedure prescribed by Pearl Harvesting.

The result of this search yielded an estimated 7115 unique, relevant citations in ERIC. The Pearl Harvesting synonym cluster in this case produced only 410 (6%) more citations. For PsycINFO the combined list from the research syntheses produced 6834 citations. The Pearl Harvested synonym cluster produced 1967 (32%) more citations.

Summary and Conclusions

The main purpose of the present study was the investigation and use of search terms for giftedness. Fifty-three harvested terms met the criteria of uniqueness and relevancy to the topic. The Pearl Harvested synonym cluster of search terms retrieved substantially more relevant citations in ERIC and PsycINFO than just using the search term gifted. This is important to note because of the tendency to search only with some variation of the term
gifted. This was seen in current systematic reviews of the literature and would likely be the case for many searching for information in the field. Just searching with the term gifted is a reasonable strategy considering the large numbers of citations it retrieves. However, it was shown here that such a search strategy is incomplete if the intent is a comprehensive literature search. A possible consequence of just using the search term gifted is that the large number of citations found could mislead the searcher into a false sense of confidence about the comprehensiveness of their search and therefore, false conclusions in his or her own research. This is potentially damaging to the field as a whole.

A second, more extensive, comparison compared the Pearl Harvested synonym cluster with the combination of search terms used in 13 recent systematic reviews. The Pearl Harvesting framework was superior in locating a greater number of relevant citations, more so in the PsycINFO database. This validated the more systematic analysis for locating search terms used in Pearl Harvesting.

The advantage of documenting a synonym cluster is its public availability as an exemplar search strategy for anyone interested in finding information. The terms need only be copied and pasted into a single search box (most databases allow for this to be done). This not only is more efficient in terms of the number of citations retrieved but also saves a searcher considerable time and effort. Once specified, there is no need to rediscover the necessary search terms for every new search. Comprehensive periodic follow-ups on new research can also be done easily by merely employing the synonym cluster again and specifying date ranges.

The present investigation provides only an initial basis for searches on giftedness. A comprehensive search involves numerous databases. Presently, there are no guidelines on how to choose from the myriad of databases available, although resources such as Ulrich's periodical database offer some information in this regard. A search also involves other subtopics, and therefore the requirement of subtopic synonym clusters.

Of course language changes as new theories and paradigms emerge. This means that synonym clusters dynamically change with advances in the field. As new terms are found they need testing to see if they contribute to the uniqueness and relevancy of the cluster. Rather than hardcopy prints of synonym clusters, digital storage offers a better way of providing constant updating. Blogs (Schmidt, n.d.), and wikis (Sandieson, n.d.) provide two examples.

Searching for literature within digital databases is essentially an act of communication with a number of people: authors and the pertinent words they use; database indexers with the terms they attribute to an article; and of course using the tools created to enact this process, e.g., the structure and search functions of the database. The Pearl Harvesting Information Retrieval Framework addresses the task of communicating with databases containing vast amounts of information. It was successful here in gathering a wide range of search terms on the topic of giftedness. It also validated the uniqueness and relevancy of each search term, with the result of retrieving an extensive collection of citations in the area. With the search tool of the synonym cluster, those involved in study, research, teaching, parenting or administration of persons with giftedness will be in a better position of navigating the information maze on this topic; better prepared to find relevant information, and make informed decisions concerning the education and lives of those who are gifted.

References


Ivanitskaya, L., O’Boyle, I., & Casey, A. (2006). Health information literacy and competencies of information age students: Results from the interactive online research readiness self-assessment (RRSA). Journal of Medical Internet Research, 8, NP.


Steenbergen-Hu, S., & Moon, S. M. (2011). The effects of acceleration on high-ability...

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Digit Ratio Effects Between Expertise Levels in American Football Players

Jörg Schorer\textsuperscript{1*}, Rebecca Rienhoff\textsuperscript{2}, Hilmar Westphal\textsuperscript{2} and Joseph Baker\textsuperscript{3}

Abstract: Previous research highlights the association between 2D:4D and performance in a host of elite sports. This study compared several variables related to the 2D:4D digit ratio among American football players of different skill levels. One-factorial analyses of variance between four groups were used. Participants came from four teams from different American Football leagues in Germany i.e., teams from the first ($n = 17$), second ($n = 24$), fourth ($n = 18$) and fifth ($n = 20$) leagues. Digit ratio was measured from digital images and t-test and analyses of variance were used to explore differences between teams and compared to normative data. The athlete sample had significantly lower 2D:4D ratio than the normative data. Further, there were significant differences for the left hand and the delta of the digit ratios of both hands but no effect for the right hand. These results add additional support for general effects for both digit ratio in elite sport; however, they also point to several areas of future research.

Keywords: expertise, genetics, hand, sport games

Over the past decade, several researchers have hypothesized that finger length, especially the ratio between the length of the second and fourth digits (2D:4D), is a biomarker of prenatal testosterone exposure, a factor proposed to predict latent talent for sports (Hönekopp & Watson, 2011; Manning & Taylor, 2001). A smaller ratio is believed to be an indicator of greater testosterone exposure. While the precise mechanism via which greater testosterone translates to superior skill is not known, a recent meta-analysis (Hönekopp & Watson, 2011) suggests it may relate to its effects on endurance (or endurance-related parameters). Regardless of the specific mechanism, over the past 10 years there have been several studies linking digit ratio with high-level sports attainment. (e.g., Bennett, Manning, Cook, & Kilduff, 2010; Bescos et al., 2009; Manning & Taylor, 2001).

Interestingly, recent research suggests that digit ratio predicts subtle differences in performance levels between athletes competing in the same sport. Kilduff, Cook and Manning (2011) found a negative relationship between right hand 2D:4D and performance, with elite male surfers. Bennett et al. (2010) noted similarly that smaller 2D:4D ratios in the right hand were found in male rugby players with more international performances (i.e., international caps). Additionally, they showed differences between coaches’ ‘first-choice’ team and remaining players in the difference between left- and right-digit-ratio.

This study compared digit span ratios between American Football players and controls to replicate previous findings on smaller digit ratios in athletes (Hönekopp & Watson, 2011; Manning & Taylor, 2001). Additionally, we considered whether there were differences between levels of competition. We expected smaller digit ratios for more elite sub-samples when compared to less elite sub-samples, especially since our sample was more heterogeneous than previous studies (Bennett et al., 2010).
Method

Participants for this study came from four teams from different American Football leagues in Germany. Because data collection occurred in the ‘offseason’, not all members of the teams participated. Team one, \( n = 17 \) played in the first league and had a mean age of 22.7 years, \( SD = 3.1 \). Team two competed in the second highest German league and had 24 players with a mean age of 24.8 years of age, \( SD = 6.2 \). The third team \( n = 18 \) played in the fourth league and had a mean age of 26.4, \( SD = 5.0 \), and the fourth team included 20 members of a team from the fifth German league, mean age = 24.4 years, \( SD = 5.9 \). All participants provided informed consent. The study was conducted in accordance with the ethical principles described in the revised declaration of Helsinki (Harriss & Atkinson, 2011).

Athletes placed their hands on a glass plate with fingers outstretched. Pictures were taken of each hand using a digital camera and these electronic images were used for further analysis. The hand images of one player were excluded due to injury. Measurements were made with MS Paint 5.1 with pixel accuracy. For each finger, three measurements were taken from the central point of the tip of the finger to the central point of the basal crease. Three independent researchers conducted the measurements and reliability was high with an intra-class correlation of .95.

The overall male athlete groups were compared to normative data for similar populations (Fink, Thanzami, Seydel, & Manning, 2006; Pokrywka, Rachon, Suchecka-Rachon, & Bitel, 2005). Left and right hand data from the athlete sample were compared to normative data taken from Fink et al. (2006) using one-sample t-tests. Analyses of variance were used to test for differences between expertise levels with Scheffé-tests as the post-hoc measure when applicable. All inferential tests were conducted with SPSS 20.0 and effect sizes and test power were calculated with G*power 3.10 (Faul, Erdfelder, Lang, & Buchner, 2007). As effect size we report \( d \) and \( f \) as proposed by Cohen (1988).

Results

Analysis of the whole football sample showed clear differences from controls for the left, \( M = .96, SD = .03, t(78) = 3.30, p < .01, d = .67 \), and right-hands, \( M = .95, SD = .03, t(78) = 9.04, p < .01, d = 1.00 \). Table 1 illustrates the relationships between digit ratio for both hands and the delta of the digit ratios across the different league levels. There was a trend towards the highest leagues showing the smallest ratio and delta and the lowest league the largest but three one-tailed analyses of variance revealed significant differences only for the left hand, \( F(3,75) = 3.57, p = .01, f = .38 \), and the delta between digit ratios of left and right hand, \( F(3,75) = 2.50, p = .03, f = .32 \), but not for the right hand, \( F(3,75) = 0.73, p = .27, f = .17, 1-\beta = .21 \). Scheffé-post-hoc-tests revealed differences between first and fourth league, \( D = .03, p = .03 \), as well as between first and fifth league for the left hand digit ratio, \( D = .03, p = .02 \). For the delta of the digit ratios of the left and the right hand only significant differences between first and fourth leagues were found, \( D = .02, p = .04 \).

Table 1. Means (and Standard Deviation) of Digit Ratios Differentiated by League Team

<table>
<thead>
<tr>
<th>Digit ratio</th>
<th>League 1</th>
<th>League 2</th>
<th>League 4</th>
<th>League 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left hand</td>
<td>.938 (.28)</td>
<td>.958 (.28)</td>
<td>.967 (.29)</td>
<td>.968 (.36)</td>
</tr>
<tr>
<td>Right hand</td>
<td>.944 (.29)</td>
<td>.949 (.33)</td>
<td>.949 (.32)</td>
<td>.958 (.23)</td>
</tr>
<tr>
<td>Delta left and right hand</td>
<td>-.006 (.22)</td>
<td>.009 (.28)</td>
<td>.018 (.25)</td>
<td>.010 (.29)</td>
</tr>
</tbody>
</table>
Discussion

The first aim of our study was to replicate previous research showing smaller digit ratios in athletes compared to controls. The effect sizes of the significant differences were in line with previous research (Hönekopp & Watson, 2011; Manning & Taylor, 2001).

Our second aim was to test for differences between heterogeneous skill groups. While there were significant differences for the left hand and the delta of the digit ratios of both hands, no effect was found for the right hand. Interestingly, some previous work examining 2D:4D differences has shown larger effects for the right hand (Hönekopp & Watson, 2010), although a recent meta-analysis of digit ratio effects in sport showed no consistent effect for right versus left hands in predicting effects in sporting domains (Hönekopp & Schuster, 2010). The medium effect size for the left hand and differences between players in higher and lower leagues (i.e., between first league and fourth and fifth league players), suggest that digit ratio distinguishes between skill levels in American football. However, the effect was not as strong as reported by Bennett et al. (2010) in rugby players.

Given the anaerobic nature of performance in American football (Pincivero & Bompa, 1997), these results may indirectly support the hypothesis that digit ratio effects are stronger in aerobic sports like rugby or track and long distance running (Hönekopp & Watson, 2011). Future work should consider the relevance of digit ratio at early stages in athlete development to determine the practical relevance of this variable for future athlete success.

References


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