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Discovering a Unique Talent: On the Nature of Individual Innovation Leadership

Larisa V. Shavinina*

Abstract: How does it happen that some individuals become exceptional innovation leaders and their organizations output a constant flow of innovation? Based on autobiographical and biographical accounts of well-known innovation leaders and integrating a number of independent directions of research, this article presents a theory of innovation leadership. The theory aims to explain the nature of innovation leadership at the individual level, that is, why some individuals are very good at both generating and implementing new ideas into practice in the form of new products, processes, or services.

Keywords: innovation, leadership, innovation leadership, “vision”, cognitive experience, sensitive periods

Introduction: Integration of Innovation and Leadership – Examination of a Neglected Topic

Today’s economy is innovation-based. Innovation – conceptualised as a transformation of creativity into new products and services – is the key process that characterizes the New Economy (Shavinina, 2003). Successful innovation generates long term, sustainable economic prosperity. Most organizations now recognize that the best way to increase corporate earnings is through top-line growth, and the best route to top-line growth is through innovation. Thus, industrial competition is increasingly harsh and companies must continuously bring innovative products and services to the global market. As such, they need innovative people whose novel ideas are a necessity for the companies’ success. Innovation leaders are especially important here: they foster innovation acting as the linchpins of companies’ innovation process, the ‘evangelists’ of an innovation and entrepreneurship culture. Innovation leaders are mostly senior executives or entrepreneurs – whatever their functions or positions – who successfully instigate, sponsor, and steer innovation in their organizations (Deschamps, 2003). The study of what innovation leadership is all about is therefore of great importance to the whole world.

Despite the obvious importance of innovation leadership in the life of any societal “organism,” one should acknowledge that this phenomenon is far from well understood. Both an expanding leadership literature and a growing body of literature on innovation have not yet studied innovation leadership systematically. For the most part, innovation leadership is discussed either by innovation management researchers in the context of the role of top management in innovation (Bessant, 2003; Hauschildt, 2003; Katz, 2003; Nonaka et al., 2003; Tidd et al., 1997; Van de Ven et al., 1999; Utterback, 1994) or by leadership scholars mostly within the topic of “leadership and organizational change” (Robert, 1991; Schriifer & Vansina, 1999; Shamir, 1999) involving mainly such concepts as “transformational leadership” (Bass, 1998), “effective leadership” (Yukl, 1999), and “creative leadership” (Sternberg, 2003). Innovation management researchers demonstrate how important executives are for generating organizational innovations and
describe their behaviors (Katz, 1997, 2003; Tushman & O’Reilly, 1997). For instance, Van de Ven et al. (1999) observed that many – not one or a few – top managers were actively involved in the development of innovations and that they performed and often shifted among four roles: sponsor, mentor, critic, and institutional leader. However, not all managers are leaders (Kotter, 1990) and not all leaders are innovation leaders. Likewise, not every organizational change leads to innovation; as well as not every transformational leadership implies innovation leadership.

Psychologists’ contribution to the study of innovation leadership should especially be mentioned. They are mainly working in the two directions: research on creativity as the first step in innovation process (Sternberg et al., 2003), and research on climate conducive to creativity and innovation (Amabile et al., 2002). This contribution was best integrated in the special issues Leading for Innovation of the Leadership Quarterly (Mumford, 2003, 2004).

A third direction of research has recently emerged, which tries to analyze specifically the phenomenon of innovation leadership (Bower, 1997; Deschamps, 2003; George, 2003). But being at its initial stage of development, this line of investigation is mainly descriptive. The phenomenon of innovation leadership thus remains terra incognita from a research viewpoint, being only partially known primarily from some autobiographies and biographies of famous innovation leaders (Branson, 2002; Dell, 1999; Grove, 1996; Lehr, 1979; Morita, 1987). In spite of advances in innovation research, determined mostly by studies of business scholars and management science specialists (Christensen, 1997; Katz, 1997; Tidd, Bessant, & Pavitt, 1997; Tushman & O’Reilly, 1997; Van de Ven et al., 1999), and an increasing literature on leadership, we do not know for certain why it is that some individuals can be exceptional innovation leaders and others not. In other words, why are certain people – at any administrative level – able to take a lead in developing new products and services in their organizations? When can exceptional innovation leadership talent first be identified? How can this talent be developed both in terms of personal and organizational development? Because of all of this, a theory of innovation leadership presented below is an exceptionally timely endeavor: it sheds light on these important issues.

Integrating to a certain extent a number of independent research streams and being based on my studies of successful innovators-entrepreneurs, this article presents the theory aimed at the conceptual explanation of innovation leadership at the individual level. The article thus (a) introduces the concept of individual innovation leadership and provides a unified perspective on this phenomenon; (b) explains those fundamentals of innovation leadership (e.g., leaders’ unique “vision”), which have not been explained by scholars; and (c) extends existing empirical studies on innovation leadership. The theory will therefore advance our understanding of innovation leadership and its multifaceted applications in a wide range of organizational settings.

It should be pointed out that the proposed theory aimed at explaining the nature of innovation leadership at the individual level seems to be very close to what in the area of organizational psychology is known as “trait-theory” or “great man-theory” (Gehring, 2007; Kirkpatrick, & Locke, 1991; Rost & Smith, 1992). However, this is not entirely correct. The proposed theory of innovation leadership seeks to explain the very nature of this phenomenon or its fundamental/inner mechanisms. To understand the inner/fundamental mechanism of innovation leadership means to understand how this phenomenon develops within the individual. Social environment, for instance, is important, but it is only an external factor in the development of innovation leaders. Any external factors or forces do not supply scientific explanations of the phenomenon of innovation leadership at the individual level. The three levels of the manifestations of innovation leadership presented in the model below represent in fact all possible traits of innovation leaders. Nevertheless, the nature of innovation leadership cannot be explained by any possible trait of a great man or even a combination of traits (Shavinina, 1995). Developmental foundation of innovation leadership and its cognitive basis explain the very nature of this phenomenon.
According to the theory presented in this article, individual innovation leadership (which manifests itself in the extraordinary achievements of a person in any field of real activity) is a result of a specific structural organization of an individual's cognitive experience which functions as a carrier of all the manifestations of innovation leadership (i.e., its traits and characteristics). Cognitive or mental experience expresses itself in a specific type of the representations of reality (i.e., how an individual sees, understands, and interprets the world around), that is, in an individual's intellectual picture of the world. The essence of innovation leadership consists in the uniqueness of the individual's intellectual picture of the world. This is the so-called “vision,” which many leadership scholars (Bennis & Biederman, 1997; Robert, 1991; Sternberg, 2003) identified as an important facet of true leaders. In other words, according to the theory presented in this article, innovation leaders' unique view, understanding, and interpretation of what is going on in the surrounding reality are keys for the scientific understanding of innovation leadership. The internal structure of individual innovation leadership is presented at five levels: (1) a developmental foundation of innovation leadership; (2) the cognitive basis of innovation leadership; (3) intellectual manifestations of innovation leadership; (4) metacognitive manifestations of innovation leadership; and (5) extracognitive manifestations of innovation leadership. These levels are presented in Figure 1 as five layers, each of them is considered in detail below.

Figure 1. Model of individual innovation leadership.
Methodological Issues

Before presenting the theory, it should be noted that from the methodological point of view, I rely significantly on autobiographical and biographical accounts of famous innovation leaders. These accounts are perfectly suited for capturing the special characteristics of innovation leaders. Autobiographical and biographical literature is essential for the research on persons or events distinguished by their relative rarity as is the case with innovation leaders. Often autobiographical and biographical accounts provide a holistic view of the subject (Frey, 1978) allowing researcher to develop and validate theories grounded in a more direct “observation” of the individuals. The use of autobiographical and biographical literature for the study of innovation leaders presents, however, certain limitations, such as:

(1) The possible subjectivity of biographers resulting from their individual interpretations of events, thoughts, and people. These interpretations may be influenced by their personal attitudes towards the person about whom they write, an attitude potentially swayed in part by whether the latter is living or not. Autobiographers can also be very subjective and contradictory in their accounts of their own thinking processes, psychological states, and the surrounding events, which lead up to and follow their particular innovations and/or supporting actions with respect to innovations of other people.

(2) Time of writing the autobiography or biography, normally after an individual has already become a famous personality – often rely on vague memories of one’s thinking processes which may have likely been weakened or altered over time. Hence, the conclusions and reports of autobiographers – and especially of biographers – are not always very reliable. It certainly raises the issue surrounding the validity and reliability of subjective reports when they are used as data. This problem has been addressed extensively in the literature (Brown, 1978, 1987).

However, even with these limitations in mind, the use of autobiographical and biographical literature is probably one of the best sources available for the investigation of innovation leadership since this research direction is at its early stage.

The Concept of Individual Innovation Leadership and Related Issues

It is extremely important to understand the essence of innovation leadership at the individual level because it is always people who “develop, carry, react to, and modify ideas” (Van de Ven, 1986, p. 592), as well as implement them into practice in the form of new products, processes, or services (Shavinina, 2007a). Taking into account that “there has been scant attention paid to innovation at the individual and group levels” (West & Farr, 1989, p. 17), the proposed research direction seems critical. As this article deals with individual innovation leadership, that is, innovation leadership at the individual level (as opposed to corporate or organizational leadership), this concept and related concepts need to be explained.

Many people believe that creativity and innovation are synonymous. This is not entirely correct. Creativity is the generation of new, original, and appropriate ideas. ‘New’ means novel, ‘original’ refers to unexpected, unusual ideas, ‘appropriate’ means useful, applied to real-life contexts. Innovation refers to the generation and implementation of new ideas. That is, innovation includes creativity. Sometimes creativity is termed the ‘fuzzy-front end of innovation.’ Implementation is a very important aspect of innovation. This is the essence of innovation. A person may have great creative ideas, but if he or she is not able to implement them in practice in the form of new products, processes or services, nobody can say that this person is an innovator.

Some researchers believe that innovation leadership and creative leadership are synonymous. See, for example, many articles in the special issues Leading for Innovation of the Leadership Quarterly (Mumford, 2003, 2004). That is, if leaders are able to generate
great ideas, create a culture conducive to creativity and receive a lot of ideas from their employees, then they are innovation leaders. This is not entirely correct. As was mentioned earlier, creativity is the first step in innovation process. Nevertheless, the essence of innovation is the implementation of creative ideas into practice.

The difference between innovation and creativity explains the existence of innovation gaps. The concept of an innovation gap means that people have a lot of creative ideas, but they are not able to implement them due to various reasons. The difference between innovation and creativity also explains why there is a constant tension between creative people in any organization and those, who are responsible for implementation of creative ideas. Everyone knows the traits of a creative individual, such as unlimited imagination, a flow of ideas, independence in thoughts and actions, persistence, and so on (Shavinina, 1995). In contrast, human abilities to implement things often require different sets of traits including discipline and an ability to follow the developed plan.

However, there are some individuals who are very good at both generating creative ideas and implementing them into practice. Examples are Jeff Bezos, Richard Branson, Michael Dell, Bill Gates, Akio Morita, Fred Smith, just to mention a few. This is the case of individual innovation leadership.

Many innovation researchers believe that innovation is a team sport. It means that if anyone wants to implement a new idea into practice, he or she needs to involve many people. This is true, especially when we are talking about organizational innovators such as Apple Computer Inc. or 3M. Nonetheless, some individuals are able to generate great ideas and to create teams, which put those ideas into practice. For instance, Thomas Edison is a good example of an exceptional innovator. At the same time Edison considered his research laboratory, his team as his greatest invention. Again, this is the case of individual innovation leadership.

Based on findings from empirical investigations, it was concluded that innovation leaders are gifted, creative, and talented individuals (Shavinina, 2007a). Innovation leadership belongs to a general construct of high abilities along with creativity, talent, giftedness, and exceptional intelligence. Therefore, psychology of high abilities has an important role to play in explaining the nature of innovation leadership at the individual level. This article thus relies to a significant extent on findings from high ability studies, especially on the cognitive-developmental theory of giftedness (Shavinina, 2007b; 2009a). As it addresses the issue of why only certain individuals are able to instigate, sponsor, and steer innovation, a range of questions arises such as: What is exceptional about the personalities of innovation leaders? Do they have extraordinary minds? Is their exceptionality a result of a combination of their unique minds and personalities? In order to successfully address these questions, one should recognize that those individuals who are able to instigate, sponsor, and steer innovation are gifted, creative, and talented. Individual innovation leadership is therefore a special type of giftedness. Consequently, the cognitive-developmental theory of giftedness (Shavinina, 2007b; 2009a) can be applied to explain the nature of individual innovation leadership.

**Toward a Theory of Individual Innovation Leadership**

**Cognitive Experience as a Basis of Individual Innovation Leadership**

As was mentioned earlier, the nature of innovation leadership at the individual level is still an area of research that has been left relatively unexplored. Although the traits, characteristics, features, properties, and qualities of innovation leaders (i.e., their external manifestations in any real activity) have been described in the literature (Bower, 1997; Deschamps, 2003), the basis (or psychological carrier) of these manifestations has not been investigated. Attempts to understand the nature of any phenomenon based solely on listing and describing its external manifestations, including its characteristics, traits, features, qualities, and properties, are inadequate.
A new research direction is needed that considers individual innovation leadership as the sum of its two important aspects: its external manifestations and its psychological basis. Therefore, there is a need to re-examine the question of the nature of individual innovation leadership. Researchers should not simply answer the question “What is individual innovation leadership?” by merely listing its characteristics and traits (i.e., its external manifestations). Rather, they should answer the question: “What is the carrier (a basis) of the characteristics and traits associated with individual innovation leadership?”

From this fundamentally changed viewpoint, scientists should study an individual’s mental or cognitive experience – more precisely, the specificity of its structural organization. Cognitive experience is defined as a system of the available psychological mechanisms, which forms a basis for the human cognitive attitude towards the world and predetermines the specificity of his or her intellectual activity (Kholodnaya, 2002). The individual cognitive experience is the basis of individual innovation leadership or the psychological carrier of its manifestations (Shavinina & Kholodnaya, 1996). Cognitive experience – the cognitive level in the structural organization of individual innovation leadership or its cognitive basis – is formed by conceptual structures (i.e., conceptual thinking), knowledge base, and subjective mental space.

Conceptual structures are important because conceptual thinking is a form of the integrated functioning of human mind (Kholodnaya, 2002). The more conceptual thinking is the integrated phenomenon of human intelligence, the better structural organization of an individual’s intellectually creative activity is. In this case human mind functions better. Chi & Hausmann (2003) discuss the importance of conceptual structures in the context of their approach to understanding scientific innovation.

The knowledge base is the second component in the structural organization of the cognitive experience. Knowledge base plays a critical role in the development of an individual’s intellectual and creative resources (Bjorklund & Schneider, 1996; Chi & Greeno, 1987; Chi, Feltovich, & Glaser, 1981; Chi, Glaser & Rees, 1982; Pressley et al., 1987; Rabinowitz & Glaser, 1988; Schneider, 1993; Shavinina & Kholodnaya, 1996; Shore & Kanevsky, 1993). Researchers found that the quantity and quality of specialized knowledge play a critical part in highly intellectual performance and in the process of acquiring new knowledge (Bjorklund & Schneider, 1996). For example, productive problem solving cannot occur without relevant prior knowledge (Chi & Greeno, 1987). The knowledge base can facilitate the use of particular strategies, generalize strategy use to related domains, or even diminish the need for strategy activation (Schneider, 1993). It was demonstrated that intellectually gifted people are distinguished by an adequate, well-structured, well-functioning, and elaborate knowledge base, which is easily accessible for actualization at any time (Kholodnaya, 2002; Rabinowitz & Glaser, 1985). Moreover, this rich knowledge base can sometimes compensate for overall lack of general cognitive abilities (Pressley et al., 1987; Schneider, 1993).

Conceptual structures and the knowledge base generate subjective mental space, the third component in the structural organization of cognitive experience. Individual differences in flexibility, differentiation, integration, and hierarchical structure of the mental space influence a person’s cognitive attitude to the world and, therefore, determine his or her intellectual and creative abilities, which lead to new ideas resulting into innovation. A more detailed review of the influence of flexibility on innovation can be found in Georgsdottir, Lubart & Getz (2003). When we say, for example, that innovation leaders are flexible people (Deschamps, 2003), it means first of all that boundaries of their mental space are flexible. The flexibility of innovation leaders and their minds originates from the flexibility of their mental spaces.

**Innovation Leaders’ Unique “Vision”**

Cognitive experience expresses itself in a specific type of representations of reality – that is, how an individual sees, understands, and interprets what is going on in the surrounding
reality and in the world around him or her. Highly intelligent persons, including innovation leaders, see, understand, and interpret the world around them by constructing an individual intellectual picture of events, actions, situations, ideas, problems, any aspects of reality in a way that is different from other people. Because of that, their individual intellectual picture of the world (i.e., world view or “vision”) is a unique one (Shavinina & Kholodnaya, 1996). This is an explanation of why numerous leadership researchers and innovation leaders have pointed out that “vision” is a central element of leadership. Root-Bernstein (2003) emphasized that sometimes perceiving the world differently is the key to making discoveries. Chi & Hausmann (2003) and Georgsdottir, Lubart & Getz (2003) highlighted the importance of changing perspective for new ideas to appear. For example, Xerox’s great scientists and engineers at its Palo Alto laboratory (PARC) invented the very first computer and a lot of related things. However, neither they nor Xerox top management knew what to do with those inventions. It was Steve Jobs, who during his visit to PARC, saw a prototype of the Macintosh and immediately realized the future of computing. As he recalled in 1996, “When I went to Xerox PARC in 1979, I saw a very rudimentary graphical user interface. It was not complete. It was not quite right. But within 10 minutes, it was obvious that every computer in the world would work this way someday” (quoted in Bunnis & Biederman, 1997, pp. 79-80; italics added).

One aspect of the unique “vision” of innovation leadership is connected with their objectivization of cognition, that is, they see, understand, and interpret everything in a very objective manner (Shavinina, 1996). It is important to note that scholars in the field of innovation point out that innovation does not necessarily imply acceptance and implementation of only objectively new ideas. Ideas can also be subjectively new ones – new only for some individuals or companies, but not for the rest of the world. Innovation leaders are those people, who are able to generate new ideas themselves, recognize and support such ideas in others, and implement those ideas into practice. In this light “new ideas” refer to objectively new ideas, because the very essence of innovation leaders resides in their ability to see the world from an objective point of view. Kaufmann (2003) also pointed out that novelty of ideas must be objective, and not only subjectively novel to its originator. Kholodnaya’s (1990) understanding of human intelligence as the mechanism for structuring specific representations of reality – representations connected with the reproduction of “objective” knowledge – suggests that the degree of development of the ability for the objectivization of cognition determines one’s own intellectual and creative productivity and innovative behavior. She demonstrated that one of the distinguishing features of intelligent individuals’ representations of reality is their objective character. In this respect the most important conclusion is that “...the significance of intellectually gifted individuals in society should be seen not only in that they solve problems well and create new knowledge, but mainly in the fact that they have the ability to create an intellectual (objective) picture of the world, i.e., they can see the world as it was, as it is, and as it will be in its reality” (Kholodnaya, 1990, p. 128; italics added). This is why many innovation leaders – say, Jeff Bezos, Richard Branson, Michael Dell, Steven Jobs, Akio Morita, Sam Walton, just mention a few – are exceptional in “sensing” or seeing new opportunities, which turn out to be highly profitable for their companies. This is because innovation leaders have objective vision, that is, objective representations of reality (for example, market reality). For example, Richard Branson upgraded his fleet at Virgin Atlantic during an economic down-turn – at rock-bottom prices – because other airlines weren’t buying new aircrafts. His vision was that that economic down-turn was the best time to upgrade his fleet. Also, he sold out from computer game distribution business just in time to miss down-turn in market.

The ability of innovation leaders to see any aspect of the surrounding reality from an objective viewpoint is very important in business settings. Innovation leaders are able to objectively see either hidden consumers’ needs, or potential developments in these needs, or changes in technology, or something else. For example, Akio Morita – a co-founder of Sony and its Chairman – saw a great market opportunity for Walkman. However,
it appeared despite strong marketing input to suggest there was no demand for this kind of product. The marketing department at Sony strongly resisted Akio Morita's idea of the Walkman. Their research demonstrated that nobody would buy this product. Marketing personnel even argued that there is no such word as ‘Walkman’ in the English language and it would sound very strange to English-speaking people. In this light, senior management at Sony also resisted the idea of the Walkman; but only the powerful intuition of Mr. Morita saved it. At the peak of resistance he threatened the Board of Directors by saying: “I will resign from my position of the Chairman of Sony if we do not sell 100000 Walkmans in the first 6 months” (Morita, 1987). All in all, Walkman became Sony's bestselling product and Mr. Morita was awarded by the Royal Society in the U.K. for his contribution to the development of the English language. That is, he introduced the words Sony and Walkman.

As was mentioned earlier, many researchers believe that innovation in contemporary companies is a team sport, an endeavor of many players. Modern companies have R & D departments, marketing channels, and so on for successful development of novel ideas and their transformation into new and profitable products. This is essentially what allows one to call innovation a ‘team sport’. Nevertheless, one cannot deny that new ideas appear in the minds of certain individuals, which are able to implement those ideas into practice. It may be surprising that innovation is not a very frequent event in today's companies, in spite of its quite evident importance. The main reason is that companies do not have enough innovation leaders with the ability to objectively see every aspect of their business activity. In this light the study of the objectivization of cognition of innovation leaders – who are responsible for new products, processes, and services in today's organizations – is a promising research direction for innovation leadership scholars.

The whole structural organization of an individual's cognitive experience (i.e., its conceptual structures, knowledge base, and subjective mental space) determines innovators' unique intellectual picture of the world. The objectivization of cognition is one of the important aspects of this uniqueness. Experimental studies demonstrated that the individual cognitive experience of "gifted" individuals and those who were not identified as "gifted" (i.e., "average") shed light on other aspects of their unique intellectual picture of the world or "vision" (Shavinina & Kholodnaya, 1996). For example, in comparison with "average" individuals, "gifted" people's representations of the reality consisted of a predominance of categorical (generalized) cognition. The "gifted" groups' representations of the future are characterized by the differentiation of the "vision" of future events. "Gifted" individuals were also distinguished by more complex and rich conceptual representations (i.e., their representations are quite unfolded and clearly articulated phenomena). Therefore, "gifted" individuals are characterized by more categorical, differentiated, integrated and conceptually complex individual intellectual picture of the world. As innovation leaders are gifted, creative, and talented individuals, then their cognitive experience is a differentiated and integrated phenomenon. Correspondingly, their representations are generalized, categorical, conceptually rich, and complex (Shavinina & Kholodnaya, 1996). This allows innovation leaders to have a unique intellectual picture of the world or "vision," which expresses itself in their exceptional performance and achievements (e.g., in their ability to generate new ideas, recognize and support such ideas in others, and implement them into practice).

Up to this point, a few determinants of the uniqueness of innovation leaders' intellectual picture of the world or their "vision," have been discussed. These are: 1) innovation leaders' objectivization of cognition, 2) their differentiated and integrated cognitive experience, and, as a consequence, 3) their generalized, categorical, conceptually rich, and complex representations.

Thus far, the basis of innovation leadership (i.e., an individual's cognitive experience) was explained. In other words, the psychological basis of its various manifestations (i.e., traits, characteristics, features, and properties) was considered. The three levels of the manifestations of innovation leadership are presented below.
Manifestations of Individual Innovation Leadership

The first level is the level of intellectual and creative abilities and it is composed of intellectual and creative productivity of innovation leaders, as well as their cognitive styles. Intellectual productivity includes three types of the properties of human intelligence: level properties, combination properties, and process properties. That is, all properties of human mind identified by psychological science were categorized into these three types (Kholodnaya, 2002).

Level properties characterize the achieved level of intellectual functioning — both verbal and non-verbal. These properties form a basis for such cognitive processes as rate of perception, capacity of short- and long-term memory, attention, vocabulary, and so on. The ability of leaders to pay more attention to everything around them and pick the most relevant information is based on these intellectual properties. Again, Xerox's corporate research center employed many talented scientists and engineers, however it was an external visitor – Steven Jobs – who got the idea for the Macintosh computer after visiting the center where he saw a prototype model.

Combination properties of intelligence characterize the ability to decipher various links, connections, and relations between different concepts. In general, it is the ability to combine the components of experience in various ways (spatial, verbal, etc.). These intelligence properties underlie the human ability to produce various associations and/or analogies, which are exceptionally important for generating creative ideas by innovation leaders. As Steven Jobs emphasized, “Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they did not really do it, they just saw something... This is because they were able to connect experiences they have had and synthesize new things” (quoted in Bennis et al., 1997, p. 66; italics added). Conger (1995) found that a distinctive characteristic of visionary leaders is their ability “to see parallels outside of one’s industry” (p. 56).

Process properties of intelligence characterize the elementary operations of information processing, as well as strategies of intellectual activity. Conger (1995) concluded that visionary leaders are distinguished not only by an ability to synthesize diverse information, but also by an ability to weed out the irrelevant elements. As Fred Smith of Federal Express noted, “the common trait of people who supposedly have vision is that they spend a lot of time reading and gathering information, and then synthesize it until they come up with an idea” (quoted in Conger, 1995, p. 56).

Creative productivity refers to the originality, fluency, and flexibility of thinking, and to the ability to generate new, original and appropriate ideas (Georgsdottir et al., 2003; Lubart, 2001–2002). Although creativity manifestations of innovation leadership seem to be the most appropriate in the context of this article, they will not be considered in detail here, because there is a vast body of literature on this topic (Amabile, 1988, 1996; Runco & Pritzker, 1999). A real novelty of this theory resides in the emphasis that the originality, fluency, and flexibility of thinking are not the basis of innovation leadership. As was discussed earlier, the real basis of innovation leadership is an individual's cognitive experience, which serves as a psychological carrier of all manifestations of innovation leadership, including the creative ones. That is, the originality, fluency, and flexibility are derivatives from the individual cognitive experience. This means that flexibility, differentiation, and integration of an individual's mental space determine one's own creative abilities. The individual mental space is one of the above-mentioned components in the structural organization of one's own cognitive experience. In other words, if one says that Richard Branson is a flexible person, it means first of all that the boundaries of his or her mental space are highly flexible.

Cognitive styles provide valuable information about individual differences in the functioning of cognitive processes of innovation leaders. For example, reflectivity-impulsivity cognitive style displays individual differences in the speed and accuracy with which people propose and formulate hypotheses and make decisions under conditions of
uncertainty. Today's reality, in the fast-paced business world, is that a company's leaders must be able to propose new ideas and make informed, critical, high-staked decisions under conditions of uncertainty. For instance, Michael Dell was convinced a few weeks before starting his company that, "...this was absolutely the right time to go for it." Innovation leaders are able to make right decisions under conditions of high uncertainty (Shavinina, 2007a).

Experimental studies showed that gifted individuals are distinguished by a reflective cognitive style: they made fewer errors in the situation of multiple choices (Shavinina & Kholodnaya, 1996). From the viewpoint of basic cognitive mechanisms, it means that the gifted accurately analyze visual space up to the moment of making decisions. In other words, they are more careful in evaluating alternatives, hence making few errors. Individuals, who were not identified as gifted, on the other hand, presumably hurry their evaluations thereby making more mistakes. The active character of visual scanning by the gifted indicates a capacity to delay or inhibit a solution in a situation containing response uncertainty, and also a capacity to differentiate unimportant and essential features of the external stimulus. When I assert that innovation leaders are exceptionally able to generate new ideas, recognize and support them in others, and implement those ideas into practice, it implies that they are able to carefully evaluate those ideas as well as the possible alternatives. Autobiographical accounts of innovation leaders show that they are able to take timely and accurate decisions under conditions of high uncertainty (Branson, 2002; Dell, 1999; Grove, 1996; Morita, 1987). This example of the reflectivity-impulsivity cognitive style demonstrates its significance for understanding innovation leadership. Other cognitive styles (e.g., cognitive complexity-simplicity) are equally important, since they shed light on a wide range of manifestations of the cognitive experience, which is a basis of individual innovation leadership.

The second level of the manifestations of innovation leadership is formed by metacognitive abilities (i.e., metacognitive awareness and regulatory processes). Metacognitive awareness refers to: (a) a system of knowledge about the basic manifestations of intellectual activity in general and about one's own cognitive processes, (b) the ability to evaluate the 'strong' and 'weak' aspects of his or her own intellectual functioning and to compensate for one's own weaknesses and rely on strengths, and (c) the ability to manage his or her mental work by using various stimulation methods. Regulatory processes include planning, guiding, monitoring, and coordinating one's own cognitive processes.

Researchers found that metacognitive abilities are critical for the productive functioning of the human mind (Brown, 1978, 1987; Butterfield, 1986; Campione & Brown, 1978; Flavell, 1976). Knowledge about one's own intellectual creative abilities and the whole cognitive set-up, evaluating their efficiency, advantages and limitations, as well as planning, monitoring, and executive control are among important human abilities (Pressley et al., 1987; Shore & Kanevsky, 1993; Sternberg, 1985). Moreover, research showed that less intelligent persons are characterized by a more superficial metacognitive understanding of their own cognitive systems and of how the functioning of these systems depends upon the environment. It is also found that less intelligent people use executive processes that are not complete and flexible for controlling their thinking (Butterfield, 1986).

Innovation leaders are characterized by highly developed metacognitive abilities. For example, Michael Dell recalled that a month before opening his company “I knew in my heart that I was on to a great business opportunity... I knew what I wanted to do: build better computers than IBM, offer great value and service to the customer by selling direct, and become number one in the industry” (Dell, 1999, p.11).

However, it is not enough. Innovation leaders also know what they do not know and how to compensate for what they do not know. This is another important aspect of metacognition. For example, those who knew the co-founder of Apple, said, “Steve Jobs was not just a lucky kid. He knew what he didn't know, and sought people who did.”
Here we approach a very important problem. Innovation leaders do not possess by all the traits of gifted and creative people, which were identified by researchers. They do not worry about this at all, because they know when, where and how to compensate for their weaknesses and rely on their strengths. Their metacognitive abilities help them to compensate for a lack of creativity, knowledge, or something else.

Innovation leaders’ abilities to implement things – or executive abilities – is very important because innovation is essentially about the implementation of new ideas into practice. A couple of years ago one management book became a bestseller on Amazon.com. Why? Because its authors found that many executives never execute. This is why the topic of innovation gap is a critical one: people have a lot of great ideas, but they are not able to implement them due to various reasons. By definition, our human abilities to implement things – or our executive abilities – are in fact our metacognitive abilities.

Ann Brown and other researchers working in the area of metacognition designed special educational programs aimed at developing children’s metacognitive abilities (Brown, 1994; Brown et al., 1989). Innovation education – aimed at developing talents of innovation leaders – should therefore include the best from the metacognition programs (Shavinina, 2009b).

Finally, the third level of the manifestations of innovation leadership consists of extracognitive abilities (Shavinina, 1994; Shavinina et al., 2004), which refer to four interrelated – and at the same time obviously different – components. These are:

- specific feelings: feelings of direction (in one’s own business activity and in search of mentors), harmony, and style, including senses of ‘new products or services,’ ‘good’ ideas, ‘promising technologies and elegant solutions’; and feelings of “‘being right, being wrong, or having come across something important;”
- specific beliefs (e.g., belief in elevated standards of performance and in hard work),
- specific preferences and intellectual values (e.g., the “inevitable” choice of the field of endeavor and internally developed standards of working), and
- intuition.

The word “specific” embodies the uniqueness of these components in innovation leaders. Leadership literature and (auto) biographical accounts provide plenty of evidence, which demonstrate that extracognitive abilities predict individual innovation leadership of the highest level. Thus, in his studies of visionary leaders Conger (1995) identified their amazing sense of purpose. Steve Jobs’ feeling of being right and sense for new products expressed in an unalloyed confidence is considered as his defining characteristic\(^2\). Richard Branson’s “instinctive understanding of what your customer wants”\(^3\) is nothing else but his unique intuition. The new CEO of Shell, Linda Cook strongly believes in hard work\(^4\).

Michael Dell is distinguished by highly developed extracognitive abilities. Recalling the days before the registration of his company, he wrote, “… at age eighteen… I definitely felt that I was diving into something pretty major… I felt that this was absolutely the right time…” (Dell, 1999, p. 11). His ‘instinct’ is nothing more than his unique intuition: “I believe opportunity is part instinct…” “We had the sense that we were doing something different, that we were part of something special” (Dell, 1999, p. 29).

Extracognitive abilities of innovators drive their exceptional persistence and determination: “… it’s interesting to note that many people told us the direct model would fail in virtually every country… Believe in what you’re doing,” says Michael Dell (Dell, 1999, p. 29). Innovation leadership is therefore determined in part by specific preferences, feelings, beliefs, and intuitive processes, which constitute a whole field of unexplored phenomena in research on innovation leadership.

The next section will address the issue of what might happen in the individual development of innovation leaders, which might eventually make them more open to innovation and consequently able to generate new ideas, recognize and support such ideas in others, and implement them into practice.
Developmental Foundation of Individual Innovation Leadership

Deschamps (2003) research on innovation leadership shows that innovation leaders are extremely fascinated and receptive to new ideas proposed by their colleagues and subordinates, which may potentially lead to new products or services. This fascination by and receptiveness to new ideas motivate them to instigate, support and sponsor innovation. Researchers found that openness to new experience is an important trait of creative people (Shavinina, 1995, 2003). Innovation leaders are open to innovation due to their sensitivity to everything new (Shavinina, 2007a). Thus, Martindale (1999) noted that many creative and innovative people – in any field of human endeavor – point out that sensitivity is one of the essential characteristics of their personalities. Conger (1995) found that visionary leaders experienced something early in their lives that heighten sensitivity to constituents and markets. Saxenian’s (1994) research on Silicon Valley companies and their leaders demonstrated that those leaders were exceptionally good at sensing market opportunities for new waves of high tech products. This ability of leaders was not however explained by researchers.

Sensitivity as a personality characteristic has its roots in the individual development of innovation leaders, particularly in their advanced development during childhood. In other words, if one wishes to know why it is that innovation leaders are able to produce new ideas resulting into innovative products and services, are open to supporting innovation in others, and are able to implement them into practice, then one should look at their advanced childhood and adolescent development. That is, something unique happened to innovation leaders in their childhood and adolescence. This section sheds light on what exactly might happen.

Advanced development can be defined as the development, which leads to the significant expression of an individual's potential – in the forms of innovation, exceptional creativity, or talent – and results in any socially valuable human achievement or performance (e.g., in new ideas leading to new products, processes, or services). The essence of advanced development in childhood is connected to the uniqueness of a child’s age. In the individual development of a child – including its cognitive, intellectual, emotional, personality, psychomotor, and social aspects – there are certain age periods of heightened sensitivity, which are known as sensitive periods. The underlying mechanism of the advanced development that actualizes potentially high abilities of children and adolescents can be seen in sensitive periods.

Sensitive periods are defined here as special periods during human development when individuals show great openness to everything in the world around them. Sensitivity refers to an individual’s idiosyncratic, personal, and heightened responsiveness to everything going on around him or her (Leites, 1996; Shavinina, 1997; Vygotsky, 1972). Shavinina (1997) distinguished cognitive (i.e., sensitivity to any new information), emotional (i.e., sensitivity to one's own inner world and to the inner words of other people), and social kinds of sensitivity, which intersect with one another, forming mixed kinds of sensitivity. Innovation leaders are characterized by at least one of these kinds of sensitivity. Vulnerability, fragility, empathy, and moral and social responsiveness are among some of the manifestations of sensitivity (Shavinina, 1999; Silverman, 1997). Cognitive sensitivity is especially important in a child and adolescent's development: the first years of a child's life are characterized by the ease and stability of knowledge acquisition and of the development of many abilities, skills, and habits (for example, linguistic abilities; Leites, 1996). Shavinina (1999) suggested that because of cognitive sensitivity, children's knowledge acquisition is very quick; it may take place even from the very first experience. Sensitive periods therefore provide exceptionally favorable inner conditions (i.e., conditions provided by the process of human development itself) for intellectual and creative development. As Vygotsky (1956) emphasized, “during these periods, certain influences have a big impact on the entire course of individual development by provoking one or another deep changes. During other periods, the same influences might have no
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...effect or even an opposite impact on child development. Sensitive periods coincide fully with [...] the optimal times for learning" (p. 278).

Sensitive periods during childhood prepare and temporarily conserve favorable inner possibilities for advanced development. Because of age sensitivity learning is more successful in the early years than in the elder ones. This is a key to the explanation of fast knowledge acquisition by gifted children that in turn leads to their advanced development (Shavinina, 1999). Sensitive periods thus mean a qualitatively new strengthening of the possibilities for mental growth, which appear during the early childhood years of innovation leaders. The strengthening of such possibilities leads to the general heightening of an individual’s cognitive resources. This is why innovation leaders are often more than innovation leaders, that is, they possess a few talents and demonstrate more than just one leadership talent. They can be talented engineers such as Andy Grove and Gordon Moore or software developer like Bill Gates. This is because they developed during sensitive periods an exceptional ability to acquire knowledge quickly, to learn faster than others. This is also an explanation why many businessmen in Silicon Valley are able to sense new market opportunities and, as a result, introduce advanced cutting-edge technological products (Saxenian, 1994).

The developmental trajectory of Michael Dell during his childhood and adolescence provides a strong evidence of his heightened sensitivity to everything around him (e.g., to “business opportunities”). For example, being twelve years old, he got into stamp collecting where he soon saw “a commercial opportunity.” That is, he decided to create his own auction where he “could learn even more about stamps and collect a commission in the process” (Dell, 1999, p. 4). He got neighbors to consign their stamps to him, and then advertised “Dell’s Stamps” in Linn’s Stamp Journal. Finally, he typed, with one finger, a 12 page catalog (he did not yet know how to type, nor had a computer) and mailed it out. He made $2,000 on his very first business venture. The roots of the famous “direct model” of Dell Computer Inc. lie here, when Michael first experienced the power and the rewards of being direct (i.e., eliminating the middleman). When he was sixteen, he saw an even greater opportunity: he got a summer job selling newspaper subscriptions to The Houston Post and had made $18,000 that year.

However, even earlier in his life, Michael had been fascinated with the idea of eliminating unnecessary steps. Thus, when he was in third grade, he sent away for a high school diploma. An eight-year-old Michael had seen the advertisement in the back of a magazine: “Earn your high school diploma by passing one simple test,” it said. He liked third grade, but trading nine years of school for “one simple test” seemed like a pretty good idea to him (Dell, 1999, p. xv). When a woman from the testing company came, both she and Michael’s parents decided that he applied to take the test as a joke. But he was quite serious...

Sensitive periods of innovators accelerate their mental development through the actualization of their intellectual potential and the growth of the individual’s cognitive resources. Michael Dell provides a strong evidence of it. Thus, he wrote about his decision at the age of 12 to create his own stamps auction: “It was obvious to me from what I’d read and heard that the value of stamps was increasing, and being a fairly resourceful kid, I saw this as an opportunity” (Dell, 1999, p. 4). Later, at the age of 16 he noticed a pattern in selling newspaper subscriptions. He discovered two kinds of people who almost always bought subscriptions: those who had just married and those who had just moved into new houses or apartments. Michael figured out how to find all these people and targeted them. His pattern led to a profitable business: the subscriptions came in by the thousands.

Sensitive Periods: Developmental Losses and Individual Acquisitions

Nevertheless, the reality is that favorable possibilities for individual development granted by sensitive periods will weaken at a slow or fast rate. The following question then arises:
can sensitive periods experienced by a child be predictors of his or her creative productivity in adulthood, which may lead to innovation leadership? The answer to this question will be “yes” only if two important requirements are fulfilled during childhood. First, all developmental capacities (i.e., new abilities, habits, skills, qualities, traits, etc. acquired during a certain sensitive period) should be transformed into stable individual acquisitions. Second, these acquired individual capacities should, in turn, be transformed into unique cognitive experience (Shavinina, 1999).

Although all stages of childhood can be distinguished by the heightened sensitivity (as compared to that of adults), sensitive periods have their own “life story.” Sensitive periods emerge, exist, and even disappear during a child’s development (Leites, 1996). What is important is what remains in the child at the end of sensitive period(s), as s/he grows older and favorable opportunities for advanced development weaken. It is important to note that although the favorable possibilities opened up by sensitive periods allow a child to advance significantly in his or her development by acquiring new and valuable knowledge, skills, and habits, he or she can also lose these acquisitions when a sensitive period ends. That seeming paradox is at the crux of, and is a real problem of, sensitive periods. Because of that Leites (1988, 1996) differentiates between developmental and individual aspects of sensitive periods.

If, at the end of a sensitive period a child loses almost all the exceptional capacities that he or she acquired during the given period, then one can assert that these capacities were mainly a developmental phenomenon (i.e., developmental capacities that disappear with age). This is key to understanding why so many creative and talented individuals who demonstrated exceptional abilities in childhood, for example, leadership, become ordinary adults who do not display extraordinary talents or outstanding creativity. Gifted children lose their unique abilities and talents in the process of their own individual development (Shavinina, 1999). This is why significantly more innovation leaders were lost than were developed by society.

At the same time, sensitive periods are a good foundation for powerful individual gains. If new extraordinary capacities acquired during a certain sensitive period remain in the developing child after this period, then one can assert that these capacities have been transformed into individual acquisitions. Only in this case one can suppose, to a great extent, that the child has the potential to be an intellectually creative adult, potential innovation leader.

The Nature of Advanced Development in Innovation Leaders

The analysis of the gifted at sensitive periods demonstrated the following tendency: their sensitive periods usually are linked sequentially or in chains (although the periods may overlap; Shavinina, 1999). This means that these individuals are always at sensitive period(s). In other words, their sensitivity does not disappear completely. In contrast to the previously mentioned opinion that sensitive periods emerge, exist, and disappear during childhood development (Leites, 1985, 1988), the chain of sensitive periods in the development of highly able individuals testifies to the lasting sensitivity. Research supports this conclusion. Thus, Silverman (1993) pointed out that “extraordinary levels of sensitivity and compassion do not disappear with maturity. A capacity for rich, intense emotions remains in the personality throughout the lifespan” (p. 642). Probably, this depends on the kind of sensitivity (i.e., cognitive, emotional, or social). Perhaps emotional sensitivity, more than any other kind, remains in the individual during his or her life, whereas cognitive sensitivity changes periodically; but definitely it does not disappear in creative and talented people. Such characteristics as sensitivity to a new experience and openness of mind – which are mentioned by many contributors to The International Handbook on Innovation (Shavinina, 2003) as essential traits of innovators – can be regarded as evidence of this tendency of cognitive sensitivity. The availability of cognitive sensitivity throughout the lifespan determines the exceptional mental abilities of an individual. That is, if sensitivity remains in the gifted for a long time, then it is quite
reasonable to state that new capacities acquired during a certain sensitive period will also remain for a long time. These capacities are fortified and developed later, and finally they are transformed into stable individual acquisitions that have a potential to remain in the person throughout the lifespan. In this case one can predict to a certain extent the transition of a talented child to an innovation leader who will be able to excel.

Moreover, the revealed chain of sensitive periods in the development of the gifted indicates a natural overlapping of age sensitivity. It means that they are always in sensitive period(s). The overlapping of sensitivities is one of the keys to explaining the inner nature of advanced development. Such an overlapping of age sensitivities means that a child's sensitivity originates from different (i.e., previous, current, and subsequent) childhood periods. Furthermore, the overlapping of an individual's sensitivity determines duplication and even multiple strengthening of the foundations for the rapid intellectually creative growth that results into advanced development of potential innovation leaders. If they are always in sensitive periods, then the likelihood of the transformation of all developmental capacities into the individual abilities is getting significantly high. Being permanently in sensitive periods also implies the actualization of the gifted's immense cognitive potential and acceleration of their mental development. The latter implies rapid accumulation of the gifted's cognitive resources and the construction of those resources into the unique cognitive experience that continues to enrich itself in the process of the further accelerated development governed mainly by heightened cognitive sensitivity (Shavinina & Kholodnaya, 1996). Their unique cognitive experience means their unrepeatable intellectual picture of the world or unusual “vision.” All the above written concerning sensitive periods demonstrates that they are not a factor, condition, characteristic, feature, or trait in the development of innovation leaders. Such periods are an inner mechanism of advanced development of innovation leaders. Conger (1995) is right in this context when he concluded that visionary leaders experienced something early in their lives that allowed them to sense new opportunities later.

Sensitive periods therefore constitute a developmental foundation of innovation leadership in that they provide a basis for an extremely accelerated mental development. This intellectual acceleration leads to fast actualization and development of one's own mental potential and its transformation into the unique cognitive experience that, in turn, forms a cognitive basis of individual innovation leadership. There is a lot of evidence of the advanced, accelerated mental development of innovation leaders. For instance, Jeff Bezos, Warren Buffett, Bill Gates, and Mike Lazaridis, just to mention a few, were intellectually gifted children. To be more precise, Warren Buffett was a mathematical prodigy, Jeff Bezos and Mike Lazaridis demonstrated unusual scientific talents, Bill Gates was an exceptionally intellectually advanced child.

**Summing-up**

In light of ever increasing importance of innovation in contemporary society, one should acknowledge that innovation leadership was not a focus of intensive research. Individual innovation leadership is an almost uncharted territory on the map of innovation studies. This article presented a theory of innovation leadership, thus filling an apparent niche in the field. The theory explored an issue of exceptional significance necessary for a scientific understanding of the nature of innovation leadership, namely: how does it happen that some individuals become innovation leaders. In order to successfully address this issue, it was argued that mainly psychological mechanisms should be taken into account, specifically developmental and cognitive processes. The theory explained (1) the developmental foundation of individual innovation leadership, (2) its cognitive basis, and its (3) intellectual, (4) metacognitive, and (5) extracognitive manifestations. They constitute the first, second, third, fourth, and fifth levels, respectively, of the internal structure of individual innovation leadership.

The developmental foundation of individual innovation leadership is related to the advanced childhood development of innovation leaders that manifests itself in their
accelerated mental growth, beyond which there are periods of heightened sensitivity. In other words, during the childhood years of innovation leaders, certain “temporary states” – or sensitive periods – emerge which provide significant opportunities for advanced development. Sensitive periods accelerate a child’s mental development through the actualization of his or her intellectual potential and the growth of the individual’s cognitive resources resulting in the appearance of a unique cognitive experience. Such accelerated development further facilitates rapid and deep knowledge acquisition, intellectual functioning, and the creation of something new and original. This leads to advanced development of future innovation leaders. This is an explanation why innovation leaders are often ahead of their times in, say, developing new products and/or services. They advance their fields of endeavor. Innovation leaders are able to do this because their advanced development during childhood and adolescence put them ahead of others thus giving them advantages. In turn, cognitive experience of innovation leaders expresses itself in their unusual intellectual picture of the world, that is, in their unique “vision.” This “vision” is responsible for their exceptional achievements and performance (e.g., generation of new ideas, recognition and support of such ideas in others, and their implementation into practice).

To sum-up, innovation leadership at the level of an individual is a result of a specific structural organization of an individual’s cognitive experience. This organization is a consequence of the protracted inner process of the actualization, growth, and enrichment of one’s own cognitive resources and their construction into an unrepeatable cognitive experience during accelerated mental development. The direction of this process is determined by conceptual structures, knowledge base, and mental space, which are the components in the organization of a person’s cognitive experience. The unique structure of the mind of innovation leaders is being formed on the basis of this process. The uniqueness of their minds expresses itself in specific, objective representations of reality – that is, in their unique intellectual picture of the world or “vision” – which can manifest itself in a wide range of intellectual, metacognitive, and extracognitive manifestations.

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Notes

1 Kholodnaya’s (2002) research on human intelligence has demonstrated that one of the basic phenomena (i.e., a proto-phenomenon) of an individual’s intellectual life and his or her experience as a whole is his or her representations. She found that the main function of human intelligence is the construction of adequate representations of the world around. Many scholars have viewed representations to be important in understanding the nature of mind (Chi & Hausmann, 2003; Chi et al., 1981; Oatley, 1978). In cognitive science, the expert-novice research paradigm also gives credence to the importance of the phenomenon of representations in the understanding of the nature of human abilities (Chi et al., 1981; Schneider, 1993; Shore & Kanevsky, 1993). For example, Chi et al. (1981) demonstrated that the main difference between experts and novices in physics has to do with their problem representations. They found that experts classified problems according to underlying principles and rules, but that novices tended to use superficial meanings of words and diagrams in their own classification of the same problems.

2 “When he co-founded Apple in 1976, Mr. Jobs bet that there would be a mass market for computers. And there was. The launch of the Macintosh in 1984 was predicated on the
notion that giving computers a graphical interface, controlled with a mouse (then a real novelty), would broaden their appeal. He was right again... Mr. Jobs's decision in 1999 to launch a range of iMac computers in different colours was also derided, but proved popular enough to turn Apple's fortunes around. Another bold move came in 2003. With the launch of the iTunes Music Store, Mr. Jobs dared to suggest that there might be a way to get people to pay to download music from the Internet rather than steal it. Once again, his nose for a new market proved accurate: Apple now sells millions of songs every month" (Economist, 5 February 2004).

Richard Branson is convinced that “an innovative business is one which lives and breathes ‘outside the box.’ It is not just about ideas. It is a combination of good ideas, motivated staff and an instinctive understanding of what your customer wants, and then combining these elements to achieve outstanding results” (quoted in Clegg, 1999, p. 96). Conger (1995) noted that visionary leaders' ability to foresee future events is an intuitive process.

“'There is no substitute for hard work and delivering on promises... I always think of the Chinese proverb that says, 'I got where I am because of luck and the harder I work the luckier I get'” (quoted in Walmsley, 2003, p. 30).

For example, Ross Perot, the founder of Electronic Data Systems (EDS), began his career selling computers for IBM. In his job, he noticed that many of his customers could not use their computers effectively because of inadequate software provided by IBM. Ross Perot also "sensed a tremendous but unfulfilled demand for software to process state and federal medical claims" (Conger, 1995, p. 56; italics added).

Research has demonstrated that human development is not a smooth process. Instead, it contains certain stages or periods, that is, it is 'periodical' in its essence (Case, 1984a, 1984b; Flavell, 1976; Vygotsky, 1972). Investigations into sensitive periods in developmental psychology indicate a periodical nature of human development (Bornstein, 1987a, 1987b; Colombo, 1982; Leites, 1978; Lewis, 1988; Oyama, 1979). Psychologists working in the field of high abilities also point out the periodical essence of gifted development (Feldman, 1986; Leites, 1985, 1996; Morelock, 1992; Shavinina, 1997, 1999; Silverman, 1997). For example, Feldman (1986) sees giftedness as the "movement through the stages that leads to performance superior to that of most others" (p. 302). The Columbus Group's (Morelock, 1992) approach to the understanding of giftedness as asynchronous development also provides strong evidence for the 'periodical' nature of development of the gifted, creative, and talented.

Such definitions of sensitivity and sensitive periods might seem rather general; however, they appear to be expedient on the contemporary level of the study of these phenomena in innovation leaders, where the research is restricted. The literature provides clear indications that age sensitivity takes an important place in the advanced development of the creative and talented (Leites, 1996; Kholodnaya, 1993; Piechowski, 1986, 1991; Silverman, 1995, 1997). For instance, Piechowski (1991) considered sensitivity to be an individual's heightened response to selective sensory or intellectual experiences – asserting that unusual sensitivity reveals the potential for high levels of development, especially for self-actualization (Piechowski, 1986). Sternberg (1986) viewed “sensitivity to external feedback” as one of the components of his theory of intellectual giftedness.

The years over which a child acquires language are one of the best-known examples of sensitive periods (Leites, 1996). Over a very short period of time, young children easily learn different forms and constructions of languages, but it becomes increasingly more difficult to do this in later years. It is fascinating and seems paradoxical that at a time when children are learning and speaking foreign languages with relative ease in the appropriate environment, adults who have a more developed mind – and therefore seem to be able to easily manage any linguistic difficulties – cannot do as well.
Everyday life provides many examples of the difficulty with which adults learn and speak foreign languages. It seems clear that a certain age or age range – for instance, early childhood – is best suited for the specific mental activities involved in language acquisition.

It is not therefore surprising that he started a company based on eliminating the middleman (i.e., bypassing the dominant method of computer distribution). Dell Corp. sells computers directly to customers, deals directly with its suppliers, etc., all without the unnecessary and inefficient presence of intermediaries.

This was his first experience with “segmenting the market,” one of Dell Corporation's “most significant strategies for success” (Dell, 1999, p. 5).

References


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Larisa V. Shavinina is a Professor of Project Management & Innovation at the Université du Québec en Outaouais, Canada. Her main research focus is the psychology of high abilities: the nature of giftedness, the child prodigy phenomenon, scientific talent in the case of Nobel laureates, entrepreneurial giftedness, managerial talent, new assessment procedures for the identification of the gifted, as well as high intellectual and creative educational multimedia technologies (HICEMTs) aimed at developing potential abilities of gifted and talented individuals.

Over the years Dr. Shavinina’s research has expanded to encompass innovation. Her bestselling *International Handbook on Innovation* (1171 pages), published by Elsevier Science in 2003, was the first and only book of its type, and is considered the beginning of innovation science. It is aimed at unifying the field of innovation: at merging psychological, management, and business perspectives together. She introduced innovation education as a new direction in gifted education. Innovation is also an important element in Dr. Shavinina’s research on giftedness and economy.

Her publications have appeared in Gifted Child Quarterly, Journal for the Education of the Gifted, High Ability Studies, Creativity Research Journal, Review of General Psychology, New Ideas in Psychology, and others. She co-edited CyberEducation and Beyond Knowledge. Her *International Handbook on Giftedness* (1539 pages) has been recently published in 2 parts by Springer Science & Business Media. This Handbook sets a new standard for the field and will be essential to scholars’ knowledge base for years to come.
The Center for Talented Youth Identification Model: 
A Review of the Literature

Javier Tourón\textsuperscript{1*} and Marta Tourón\textsuperscript{2}

Abstract: This paper reviews the literature on the Talent Search identification model that was developed by Julian Stanley as the Study of Mathematically Precocious Youth at Johns Hopkins in the 1970s and implemented by the Center for Talented Youth from the early 1980s through to the present. Other universities in the United States have also adopted this model for talent identification and development, and it has been adapted for use in other countries. To date, more than 3.5 million students have participated in Talent Search assessments, and hundreds of thousands of students have enrolled in specialized academic programs for able learners. Here we analyze the model's founding principles, its universal characteristics, and its application and functioning in Spain. We conclude with some reflections about what we have learned and what could be done worldwide.

Keywords: SMPY, Talent Search concept, CTY, Johns Hopkins, Talent Identification, Talented Youth, CTY Spain

In recent years, we have witnessed a significant evolution in the focus and conceptualisation of high ability as new initiatives have arisen that attempt to combine high ability, talent, creativity, innovation and excellence; organisations have been founded concerned with ensuring that talent within our society develops by combining fields of study and research that are on many occasions separate. Nobody seems to be in any doubt, at least theoretically, as to the importance of educational systems as social development and intervention mechanisms. However, it is not as clear whether the concerns of the majority are aligned with the development of the talent and potential of many young people in our countries, disregarding (whether deliberately or not) the importance that it has for social construction and human liberty.

The educational process becomes the key to transforming natural abilities into systematically developed abilities, to use Gagné's terms. It is obvious that this process has to be systematically structured. In other words, the abilities or aptitudes in one or more fields shall not become naturally "operative" (so to speak). It is the structured training that will make those abilities contribute to the development of competences in a given field.

Consequently, the level of competence and skill, of expertise if you will, in a field of knowledge, shall be the result of the projection of the ability in said field, with the performance in it being the effect of educational development. In this regard, in order to be competent in a field, the abilities appropriate to the requirements of such are necessary but so, too, is an appropriate intervention program and a not inconsiderable amount of work, effort and motivation towards achievement and excellence.

It is therefore crucial to understand that talent is based on (partially inherited) personal conditions that will present themselves (in the majority of cases) in various fields of human activity. However, it is also essential to understand that talent does not develop spontaneously. Consequently, ability must be understood as potential, and talent as performance to a lesser or greater extent, in such a way that talent is the result of applying

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personal effort and willpower to the development of what are initially nothing more than uncertain potentials (cf. Gagné, 2009).

The role of the intervention programs shall be to ensure that potential manifests as performance and that potential manifests as competence\(^1\). It is therefore easier to understand that there is a significant difference between quantitative reasoning and being a good mathematician or simply having a lot of knowledge (and skills) in the mathematics field. It is true that one needs to have the ability but the work and support to implement this ability to make advanced achievements in a particular field is also necessary. This, as can be understood, has highly significant educational consequences because, as can be immediately gathered from the aforementioned, any talent that is not cultivated can be lost. However, in order to cultivate talent, it must first be identified. Consequently, identification and intervention become two axes of talent development. It does not seem necessary to insist that education must ensure that an individual’s performance matches his/her potential.

The need for special attention is all the more obvious when it is confirmed that different children who receive the same educational treatment, don’t always obtain different results. (Tourón, Peralta, & Repáraz, 1998)

It appears to be beyond all doubt that the organizational structure of the school as we know it today is based on pragmatic criteria. The worst aspect of these criteria is that they lead to an “age-grade lock step”, that immediately orientates the school system toward the ‘average student’, who as an abstract concept, does not exist anywhere. This results in the development of the same programs for all the pupils and at the same pace, a system that is far from capable of responding to the needs of a group with educational needs clearly different from those of the ‘regular’ groups.

Thus, if the school cannot respond in an adequate manner to the educational needs of all pupils through its established programs, and accepting that groups exist that are clearly differentiated and have specific needs, the identification of talented pupils makes sense, particularly when alternative programs exist to attend to the demands they present.

This is precisely the main focus of this paper, which analyzes with some detail the rationale and research results of the so-called Talent Search Model. “A Talent Search is the best-kept secret in gifted education. So if you have no idea what it is you are not alone” (Colangelo, Assouline, & Gross, 2004, p. 25).

**The Talent Search Model: A Short Description**

Several names have been used to refer to the Talent Search Model. In a relatively recent High Ability monograph, we used the CTY model expression (Center for Talented Youth), also known as the Talent Search Model, or SMPY model (Study of Mathematically Precocious Youth; see Tourón, 2005, Brody, 2009a). Any of these names can be considered as reasonable equivalents even though they all originate from the SMPY, which is the name of the project started by Professor Stanley in Baltimore at the beginning of the 1970s and that continues in place with his 50-year longitudinal study. At present, the SMPY is led by Benbow and Lubinski at Vanderbilt University (see Lubinski & Benbow, 2006, for details). However, as stated by Benbow and Lubinski, the SMPY is a misnomer as it deals not only with the mathematical aspect but also the verbal aspect and it is not only geared towards young people, rather the model has been expanded to include children and adults that currently form part of the cohorts monitored in the longitudinal study (cf. Lubinski & Benbow, 2006).

There is no question about the magnitude of the contribution of the model described here, both in the States and worldwide. Its success has gone far beyond the limits of any initial prediction that could have been made at its outset by Stanley and his associates. Today millions of students have benefited from the talent searches, programs and services provided by the universities and institutions implementing this model, or other similar models inspired by its rationale. Moreover, the research effort made to validate the model and the educational practices derived from it have been very influential in the shaping of appropriate legislation and adaptation of school practices in many places. (Tourón, 2005, p.155)
Certainly it has expanded a lot further than what Stanley could have predicted when he said, referring to those first moments when he was required to help a student, who we shall discuss later, "At first I was somewhat hesitant and perhaps even reluctant (and slow) to get involved (...). But I did, and my life and career thereafter have never been the same" (Stanley, 2005, p. 8).

(...) The principles and practices of his approach are based on three principles from developmental psychology: (1) that learning is sequential and developmental; (2) that children learn at different rates; and (3) that effective teaching involves posing problems to students slightly exceeding the level already mastered. (...) The implication of this principles is that, for students to develop their talents, 'the pace of educational programs must be adapted to the knowledge of individual children' (Robinson, 1983, p.140).

The SMPY (Study of Mathematically Precocious Youth) officially began in September 1971 and its initial objective was to identify and educate high school students who were precocious in mathematics (Benbow, 1986). In the words of Lubinski, Benbow and Sanders (1993), the original aim of the SMPY was to identify adolescents with exceptional intellectual abilities, and later, to find out which factors would contribute to their optimum educational development.

In order to achieve the first of the objectives, the decision was made to perform an annual search for talent called a Talent Search, which, since the first year it was implemented, was one of the key elements of the model.

To do this, an above-level evaluation was used, as, according to previous experiences, it seemed to be an adequate identification method. This test would be applied to 7th and 8th grade students within the top 5% of mathematical performance, based on another standardised performance test that they would have taken at school.

The first Talent Search was carried out at Johns Hopkins University on 4 March 1972. A total of 450 7th and 8th grade students (12–13 years-old) from Baltimore participated by taking mathematics and science tests that were very difficult for their age group. Many of them obtained results of around 690 points when the maximum that can be obtained in said test is 800. Keating (1974) stated that it was evident that when the aptitude or performance tests are used to evaluate the ability of these students, their results are comparable with those of students who are going to start university.

Other searches followed this one, in January 1973 and 1974, in December 1976, in January 1978 and in January 1979. These were the seed for the inception of CTY (then called OITD, Office for Identification and Talent Development). In the 1982/83 academic year, the Talent Search already formed a circuit throughout the United States, adopted by other Universities like Duke, Northwestern and Denver (See Tourón, 2005, special High Ability Studies issue on the CTY model) which has continued to grow and continues to be very effective thanks to all of the experience gathered throughout the decades.

Table 1 provides a brief breakdown of some of the data relating to the evolution of this model that show us how it has grown and what its innovations have been.

Stanley (1985) stated that it was a fortunate combination of events that allowed the Spencer Foundation of Chicago to provide a financial grant to the project for 13 consecutive years. This grant was geared towards identifying talent amongst students aged 12 to 15 years. The initial perspective was different, for example, to that adopted in Terman’s longitudinal study.

In this case, the idea was to find young people with special talents who could be helped to move, educationally-speaking, more rapidly and in greater depth.

In Stanley’s opinion, Terman and Pressey had already provided a lot of information in contrast to the prevailing stereotypes, and had pointed out the need to take appropriate educational measures with the most capable students (Terman & Oden, 1925; Pressey, 1949). However, it is not possible to use these measures without precise knowledge of the young people who need them. Consequently, effective identification was clearly the first step.
Table 1. Some Important Data Relating to the Development of the SMPY (Modified and Expanded from Reyero and Tourón, 2003)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer 1968</td>
<td>An IT teacher from Towson State University is astonished by Joe, an 8th grade student</td>
</tr>
<tr>
<td></td>
<td>who stood out very significantly in his classes.</td>
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<tr>
<td>1969</td>
<td>Julian Stanley, Professor at Hopkins, gives Joe several tests and he gets results</td>
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<td></td>
<td>that exceed those of the majority of students starting at the university. Stanley has</td>
</tr>
<tr>
<td></td>
<td>many problems finding acceptable routes for Joe’s education. Many of his proposals</td>
</tr>
<tr>
<td></td>
<td>are considered ridiculous! With Joe’s family, he decides that Joe should enrol at Johns</td>
</tr>
<tr>
<td></td>
<td>Hopkins University, where he receives his BA and Master’s aged 17.</td>
</tr>
<tr>
<td>1970</td>
<td>The parents of Jonathan, another 13 year-old student, hear about Joe’s success and</td>
</tr>
<tr>
<td></td>
<td>ask Stanley for help, who then follows a similar route with Jonathan. Four years later,</td>
</tr>
<tr>
<td></td>
<td>Jonathan became an IT consultant.</td>
</tr>
<tr>
<td>1971</td>
<td>Julian Stanley establishes the Study of Mathematically and Scientifically Precocious</td>
</tr>
<tr>
<td></td>
<td>Youth (SMSPY) in the Psychology Department at Hopkins. The Spencer Foundation provides</td>
</tr>
<tr>
<td></td>
<td>an initial grant for the 5 first years which is later extended to 13 years.</td>
</tr>
<tr>
<td>1972</td>
<td>On 4 March, the first Talent Search is performed as a method of identification.</td>
</tr>
<tr>
<td>Summer 1972</td>
<td>Fast-paced precalculus mathematics classes on Saturdays throughout the summer. Joseph R.</td>
</tr>
<tr>
<td></td>
<td>Wolfson was the teacher so this pioneering course is often referred to in literature as</td>
</tr>
<tr>
<td></td>
<td>“Wolfson I”.</td>
</tr>
<tr>
<td>1972/1973</td>
<td>Fast-paced mathematics classes continue throughout the year and for the brightest students</td>
</tr>
<tr>
<td></td>
<td>throughout August 1973 as well. This course is known as “Wolfson II”.</td>
</tr>
<tr>
<td>From 1974</td>
<td>Fast-paced calculus classes at university level. They are given on a weekly basis for</td>
</tr>
<tr>
<td></td>
<td>2 and a half hours.</td>
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<tr>
<td>1978/1979</td>
<td>Summer courses: 40 study hours led by a mentor. They are non-residential.</td>
</tr>
<tr>
<td>1979</td>
<td>A new service is set up at Johns Hopkins University encompassing everything that is</td>
</tr>
<tr>
<td></td>
<td>related to identification within the work of the SMPY. The service is named OTID (The</td>
</tr>
<tr>
<td></td>
<td>Office of Talent Identification and Development). It handles the annual Talent Searches</td>
</tr>
<tr>
<td></td>
<td>in cooperation with the SMPY. It is currently called the CTY (Center for Talented Youth).</td>
</tr>
<tr>
<td>1980</td>
<td>The “group of 13 year-olds with SAT-M results between 700 and 800” is created with</td>
</tr>
<tr>
<td></td>
<td>the aim of providing special assistance to these students (1 in every 10,000)</td>
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<tr>
<td>Summer 1980</td>
<td>First summer residential programme takes place over three weeks. Mathematics courses,</td>
</tr>
<tr>
<td></td>
<td>writing strategies and others. 221 students participate (126 choose mathematics).</td>
</tr>
<tr>
<td>1980</td>
<td>This year, verbal results are also included in the identification of the subjects.</td>
</tr>
<tr>
<td>1985</td>
<td>The 12th Talent Search is carried out with 23,000 participants.</td>
</tr>
<tr>
<td>1992</td>
<td>CTY International is founded. It is an organisation that brings together, under a common</td>
</tr>
<tr>
<td></td>
<td>model and principles, various similar initiatives that are set up in other countries.</td>
</tr>
<tr>
<td>1992</td>
<td>CTY Ireland is founded, the first charter member of CTY International.</td>
</tr>
<tr>
<td>1999 (20</td>
<td>90,400 students participate in the Talent Search. A total of 8,100 students attend the</td>
</tr>
<tr>
<td>years</td>
<td>summer courses.</td>
</tr>
<tr>
<td>since the</td>
<td>The SCAT is validated in Spain and the first studies offering data on the transcultural</td>
</tr>
<tr>
<td>foundation</td>
<td>validity of the identification model begin to be published.</td>
</tr>
<tr>
<td>of CTY)</td>
<td>CTY Spain is founded, second charter member of CTY International.</td>
</tr>
<tr>
<td>1997-2000</td>
<td>NAGTY is founded at the University of Warwick with the support of the British government</td>
</tr>
<tr>
<td></td>
<td>which incorporates the same principles as the CTY model. Other CTY’s are founded in</td>
</tr>
<tr>
<td></td>
<td>Bermuda and Thailand. They all form part of CTY International.</td>
</tr>
</tbody>
</table>
**Talent Search Principles**

The SMPY (which we would refer to as the CTY today) focuses its attention on the *students that are precocious in the verbal and mathematics* areas, even though other efforts are acknowledged and applauded in the identification and strengthening of other areas of talent. The areas that CTY deals with are central to the architecture of all school learning and good precursors to the academic potential of students. In addition, they are easy to evaluate.

The young people with the greatest potential or ability are characterised by their precociousness, by showing, at times exceptional, advancement with regard to what is normal for their age. It is precisely this precociousness that requires a different educational treatment (cf. e.g. Keating, 1976; Benbow, 1986; Keating & Stanley, 1972). The SMPY model views high ability as a synonym of precociousness (Benbow, 1991), and bases this on various research studies on the topic (Jackson & Butterfield, 1986; Keating & Schaefer, 1975; Brody & Stanley, 2005; Stanley, 2005).

There are some principles that are important for gaining an understanding of the model developed by Stanley that, as is evident to us, is the result of the practice and not of a prior theoretical idea, which is not to suggest, in any sense, that it is not perfectly founded on well-defined psycho-educational principles (Brody & Stanley, 2005).

The SMPY assumes a series of postulations on which it bases its action, both in relation to the identification processes and the implementation of intervention programs. According to Brody (1999, 2009b) these assumptions could be summarized as follows:

1. Gifted students need an appropriately challenging program if they are to achieve at their full potential.
2. The more talented the child, the greater the need for a differentiated program.
3. Above-grade-level assessments are crucial for evaluating a gifted student's level of ability and content knowledge.
4. Gifted students vary greatly in their specific abilities, content knowledge, interests, motivation, goals, personalities, and learning styles.
5. Students need access to coursework that is at a level and pace appropriate for their abilities.
6. School programs can be enhanced with curricular flexibility and articulation at the next level.
7. Students can increase their learning opportunities through supplemental educational programs and extracurricular activities.
8. Students should gain a broad background in the liberal arts.
9. Students need to be able to interact with intellectual peers.
10. Students need access to role models and mentors.

In any event, it must be understood that the CTY model was born to help with the intellectual, academic, social, emotional and definitively personal development of students and in this attempt,

> Let me try to correct a widespread, persistent misimpression about our innovations. We do not compete with school-based efforts to provide stimulation for the gifted, such as those of Renzulli and Reis (2004). Our major work is carried out during the summer. Our intent is to supplement and complement school-based instruction, not supplant, criticize or 'invade' it. (Stanley, 2005, p. 10)

The operational definition of talent that the SMPY has been using from the outset is a *high score on the SAT (School Assessment Test) at an early age*. Taking into account that the SAT is a test that is used for identification but above-level, this means that the SMPY sees high ability as a synonym of precociousness (Benbow, 1991), on the basis of several investigations into such (Jackson & Butterfield, 1986; Keating & Schaefer, 1975). In addition, the aim of the SMPY did not only involve identification, it also seeks to provide the
educational assistance most appropriate not only to the type of talent but also to its degree or level. For that reason, for Stanley (1991) the identification and the description were insufficient, they had to help the most capable young people to materialise all of their potential with the most appropriate educational measures.

The practical implications for the SMPY were for us first to identify the appropriate educational and vocational environments for the individual in question, and then attempt to arrange educational interventions congruent with the individual’s abilities and needs. (...) Essentially, SMPY promotes competence over age as the criterion to be used in determining who obtains access to certain curricula and experiences and at what time. (Benbow & Lubinski, 1997, p.158)

In principle, the Talent Search was seen as an identification mechanism, in which the tests identified those children who stood out because of their talent in the verbal or mathematical areas, and it selected them to participate in special programs. Later on, this idea was re-conceptualised and the Talent Search began to be viewed as a diagnostic tool that discovers areas and levels of ability, but in an already acknowledged high-ability population, and offers students different educational modes that are appropriate to their learning pace (Olszewski-Kubilius, 1998).

The idea is that two students, who obtain the same results in a test appropriate to their level, obtain very different results in an above-level test, as shown in figure 1. In other words, if a teacher uses the results that these two students obtain in the test at their level as a basis, he/she will place both students at the same level and offer them the same educational programs. However, if the teacher uses the results gained from the above-level test as a basis, the programs, strategies and resources used with each of them shall be different. There is no doubt that both are gifted but perhaps for one student, an enrichment program would be sufficient, whereas for the other, an advanced mathematics program would be more appropriate, with a faster pace than normal.

The standardised tests traditionally used to evaluate the academic performance of school students have a “ceiling” which is too low to identify those students whose talents are so exceptional that they require and deserve special educational opportunities. (Goldstein, Stocking, & Godfrey, 1999)

To obtain results in the 99th percentile in a test, for example the California Achievement Test, is a significant performance, but the 1% of students who are in this selected group still represent a very broad range of ability. As detailed by Benbow and Lubinski (1993), the top 1% of individuals, in the majority of distributions, span a range as broad as that which is covered by the lowest 2% to the top 2%. In terms of IQ, the range of results for the students that are in the top 1% (from 135 to 200) is as broad as the range of results between the 2nd and 98th percentile (from 66 to 134). Consequently, it is necessary to use above-level tests with the students who obtain the highest results in the in-level tests. As a result, it becomes possible to demonstrate the complete scope of their abilities.

Figure 1. Two representations of the percentile differences in the results of the students that take an in-level and an out of level test.
The innovative aspect of this model, with regards to identification, arises, in our opinion, in two aspects: a) on the one hand, in the out of level evaluation, in other words, the use of tests at levels higher than the age of the students evaluated for the identification, and b) in the description, on the basis of the student’s test results, his/her profile and characteristics are analysed alongside his/her results and the most appropriate manner of intervening in that specific case is determined. In the following, we shall analyse each of these two aspects and explain what the student identification process is.

In order to identify a significant number of students with talent, the SMPY developed the Annual Talent Search concept (both national as well as international). It is a basic identification system which is carried out in two stages, and which makes it possible to discover, relatively rapidly and very precisely, students with intellectual talent. It is designed to identify, evaluate and acknowledge students with exceptional mathematical or verbal reasoning skills.

At the Johns Hopkins University CTY, 7th and 8th grade students were traditionally involved in this process but at present, a younger age group of students, 2nd to 6th graders, can also participate and take another test, the SCAT. Talent Search programs are also conducted at other universities in the United States (for example, Duke http://www.tip.duke.edu and Northwestern http://ctdnet.acns.nwu.edu/ Universities; in fact Talent Searches cover all the States of the Union), and the model has also expanded internationally in a significant way during the last two decades (Brody, 2009a; Tournón, 2005).

There are two stages that follow:

1) In-Level Testing

In the first stage, the students who can participate in the Talent Search are selected. To be selected they must have reached a high percentile of 95 or 97 in a standardized performance or aptitude test, which will have been given to them, generally speaking, within the normal evaluation process of their schools. The CTY itself offers a very extensive list of tests that enable qualification for the Talent Search. This percentile has varied slightly throughout the years.

By way of example, between 1972, the year that the first Talent Search was carried out, and 1978, a total of 9,927 students aged between 12 and 14 years participated. The percentage stipulated to pass on to the following stage of the process can vary depending on the year, although it is always between 2 and 5% (Benbow & Lubinski, 1997).

Why the highest 3 or 5%? Goldstein, Stocking and Godfrey (1999), on the basis of the data gathered from their talent search at Duke University, demonstrated that there is a significant difference in SAT results amongst students situated in the 99th percentile of a standardized test for their level and those situated in the 98th or 97th percentile of said test (see table 2).

In other words, below the top 3–4% almost no students obtain a result above 500 in the SAT.

It is reasonable to conclude that a cutoff lower than the 97th percentile could yield few additional high scorers on the SAT or ACT [American College Testing] and would consequently result in many more experiences of frustration for the participating seventh graders. (Goldstein, Stocking, & Godfrey, 1999, p. 145)

| SAT score | Mathematics | | Verbal | |
|-----------|-------------| |         | |
| Pc. 97    | 13.4        | 1.9 | 8.1     | 0.8 |
| Pc. 98    | 16.8        | 2.7 | 11.9    | 1.4 |
| Pc. 99    | 32.8        | 9.8 | 26.6    | 5.2 |
In fact, as stated by Goldstein, Stocking and Godfrey (1999), TIP, and other programs like it, don’t seek to exclude students by using the talent search approach but rather seek to identify students who are most likely to benefit from the programs’ offering. Therefore it seems appropriate to continue the practice of using the 97th percentile as the cut-off for the talent search, keeping in mind that the cut-off is a guide rather than a barrier. (p. 145)

However, caution must be taken with a cut-off point that is too rigid or too high, as we run the risk of increasing the number of false negatives (see VanTassel-Baska, 1985). At present, many talent searches use the 95th percentile as the cut-off point in order to avoid this possible negative effect.

2) Above or Out-Of-Level Testing

This second stage of identification is one of the features that most characterises the SMPY model. The idea of using out of level tests is not a new one but its systematic and annual use to identify high ability students is new. The main advantage is that it makes it possible to discover the intellectual differences that arise amongst the most able students, which are generally hidden when conventional tests are used that tend to have a lack of discriminatory capacity. Those individual differences amongst the students are psychologically very significant and play a very important role in planning and structuring the educational intervention, particularly, if the use of accelerated resources is involved.

Benbow (1992) stated that the differences in the academic performance of young people who are in the top 1% are very evident. In a period of 10 years, between ages 13 and 23, the academic performance of those students in the top quarter of the top 1% for mathematical ability, was much more spectacular than that of those in the lowest quarter of the top 1% who also had a very high performance. Consequently, Benbow and Lubinski (1997) stated that, “differential expectations for individuals in this range, which spans the range of IQ scores from approximately 135 to over 200, are justified and should be established” (p. 159).

The out of level evaluation in the Talent Searches enables students to find out what their strengths and weaknesses are as regards the intellectual abilities most characteristic of academic excellence: verbal and mathematical reasoning.

It is interesting to note that the SAT basically acts as an aptitude test with young students. In relation to this VanTassel-Baska said that, because such younger students usually have not had advanced coursework in Mathematics or the Verbal arts, the scores reflected are more representative of aptitude rather than achievement, thus countering the charge frequently made about the SAT when used with older populations, that it measures achievement rather than aptitude. (VanTassel-Baska, 1985, p.185)

Similarly, with regard to the SAT, Lubinski and Benbow (2006), in their work related to the results of the longitudinal study of the SMPY at age 35, stated that, given the abstract nature of this measuring tool and the sheer novelty of the problems for this population, the SAT functions more as an analytical reasoning level for these students than it does for older students who have been explicitly exposed to SAT content through course work in high school. (p. 317)

Likewise, Swiatek (2007) stated that, ‘because above-level tests are given when students are too young to have been taught the test content in school, the results are best viewed as indicators of reasoning ability, not retention’ (p. 322). Many other authors support this position (see Jarosewich & Stocking, 2003; Assouline & Lupkowski-Shoplik, 1997)

Although the SAT is the test that has traditionally been used in the model, at present, and given that the groups that can participate in the Talent Search have increased, different tests are used and qualifying scores have been modified along the years (see for details: http://cty.jhu.edu/summer/summer-programs.html)

Table 3 shows the data corresponding to the operation of the identification model from the period between 1980 and 2004. The stability of such, with hundreds of thousands of students, makes it possible to speak about what Tourón (2000) calls the “out of level testing law”. It must be taken into account that the students that present themselves to the
Talent Search do so voluntarily and, consequently, do not necessarily represent one population; instead due to their high number the result has a significant explanatory capacity.

It must also be taken into account that the 7th and 8th grade students are four to five years younger than the students who normally take the SAT as a requirement for entry into many North American universities.

The fact that students so young are capable of reaching such excellent results is surprising and denotes an extraordinary ability of such in the areas measured by the test.

Table 3, originally compiled up to 2004 by Barnett, Albert and Brody (2005), has been updated with the data up to 2009 kindly provided by the CTY Talent Search department. Systematically, as is evident, around 20% of students in the top 5–3% of their age groups in the “in level” test match or exceed the average result of students taking the SAT test as a prior requirement for entry to the university, demonstrating a huge range of ability between them.

The evidence of the series leaves little room for speculation and clearly emphasises that the “competence shown” by these students is completely masked in any “in level” measurement process, and more so with regard to school tests designed by the teachers frequently geared towards the average student and low levels of difficulty.

Table 3. Percent of Talent Search Students Scoring Above Mean of College-Bound Seniors

| Year | Seventh Grade | | | Eighth Grade | | |
|------|---------------|------|-----------------|------|------|------|------|
|      | SAT-V         | SAT-M |                  | SAT-V | SAT-M |      |      |
|      | Males Females | Males Females |                  | Males Females | Males Females |      |      |
| 1980 | 24  24        | 20  21 |                  | 49  49 | 49  56 | 56  56 |
| 1982 | 19  19        | 15  20 |                  | 15  16 | 15  16 | 16  16 |
| 1983 | 19  17        | 16  16 |                  | 16  17 | 16  17 | 17  17 |
| 1984 | 19  16        | 17  17 |                  | 17  18 | 17  18 | 18  18 |
| 1985 | 19  16        | 19  17 |                  | 17  18 | 17  18 | 18  18 |
| 1986 | 19  17        | 19  19 |                  | 19  20 | 19  20 | 20  20 |
| 1987 | 18  17        | 19  17 |                  | 17  18 | 17  18 | 18  18 |
| 1988 | 15  15        | 19  16 |                  | 16  17 | 16  17 | 17  17 |
| 1989 | 19  18        | 14  13 |                  | 13  14 | 13  14 | 14  14 |
| 1990 | 16  15        | 23  22 |                  | 22  23 | 22  23 | 23  23 |
| 1991 | 18  19        | 14  16 |                  | 16  17 | 16  17 | 17  17 |
| 1993 | 19  22        | 18  21 |                  | 21  22 | 21  22 | 22  22 |
| 1994 | 18  19        | 21  25 |                  | 25  26 | 25  26 | 26  26 |
| 1996 | 20  22        | 19  25 |                  | 25  26 | 25  26 | 26  26 |
| 1997 | 24  27        | 24  27 |                  | 27  28 | 27  28 | 28  28 |
| 1998 | 25  26        | 25  29 |                  | 29  30 | 29  30 | 30  30 |
| 1999 | 22  24        | 23  29 |                  | 29  30 | 29  30 | 30  30 |
| 2000 | 23  24        | 22  28 |                  | 28  30 | 28  30 | 30  30 |
| 2001 | 22  24        | 27  32 |                  | 32  34 | 32  34 | 34  34 |
| 2002 | 25  27        | 26  30 |                  | 30  33 | 30  33 | 33  33 |
| 2003 | 24  26        | 26  28 |                  | 28  30 | 28  30 | 30  30 |
| 2004 | 23  29        | 28  30 |                  | 30  32 | 30  32 | 32  32 |
| 2005 | 22  26        | 29  27 |                  | 27  29 | 27  29 | 29  29 |
| 2006 | 21  25        | 24  26 |                  | 26  28 | 26  28 | 28  28 |
| 2007 | 26  26        | 29  26 |                  | 26  28 | 26  28 | 28  28 |
| 2008 | 27  26        | 30  29 |                  | 29  31 | 29  31 | 31  31 |
| 2009 | 27  26        | 30  29 |                  | 29  31 | 29  31 | 31  31 |

Note. a Since 1979 to 2008 1,572,595 students participated in the CTY Talent Searches (see CTY 2008 Annual Report, online access at: http://ctyjhu.org/press/report2008/ar_frame.html); b During this year, the SAT scale was re-centered so that it could adjust to the empirical results of the college bound seniors; c During this year, the composition of the SAT changed including a student-written essay; analogies were eliminated; shorter reading passages added; new content from third-year college preparatory math; quantitative comparisons eliminated (see www.collegeboard.org for further details).
This highlights the vital need to articulate systematic (periodic) processes of identification in educational systems. In addition, we will view students who are clearly different, more different even than the most disparate students that can be found in a normal class, as equal. And the worst part is that the educational needs of these students will be ignored, with the personal and professional prejudice which that leads to.

**Implementing the Talent Search: The Case of CTY Spain**

Although the Talent Search was created in America and is used systematically there, it is categorically not an “American model”. The principles behind it and the measurement process it is based on are, to our understanding, universal.

The ceiling effect of any test does not depend on the cultural contexts or on the idiosyncrasy of the populations; it depends on the level of difficulty of the items in relation to the ability of the students. In other words, if the range of difficulty of these is not sufficiently wide in relation to the potential of the students to whom the test is given, the effect will be a masking of the ability, making subjects appear as equal when their ability is, or can be, very different. It is for that reason that the “in level” tests fail when they attempt to evaluate high ability students.

This is a universal principle that goes beyond the model we are studying and that, consequently, must be taken into account in any process of detection or of diagnostics regardless of the test being used; otherwise we would not be equipped to offer the educational assistance appropriate to the various levels of ability.

We are going to refer briefly to the application of the Talent Search principles in Spain (Tourón et al. 2000, 2002, 2004, 2005b).

If we consider the number of Spanish non-university (i.e., primary and secondary) students and calculate a modest top 5% of such, the total resulting amount would be around 350,000. By referring to official figures of students actually identified we found that these barely exceed 4,000, which means that fewer than 2% of students who need specific assistance to develop their potential have been identified.

In Spain, as in many other European countries, it is not common for standardized performance tests to be used that have national or regional norms, and for that reason it is necessary to select the students from that top 3 or 5% differently from how they are selected in the U.S. In this, the evaluations of teachers, parents, self-nominations, nominations from colleagues etc. play a role, and these are all routes that we cannot discuss here.

In the case that we are going to analyse, referring exclusively to CTY Spain, we use the SCAT test, The School and College Ability Test (SCAT), which is a test originally developed by ETS (Educational Testing Service, Princeton) in the early 1970s and now owned by CTY (Johns Hopkins University). The test is designed to measure the verbal and quantitative abilities of students who are in grades 3–12. The first step taken was to validate the SCAT in Spain, a process which began in 1997 and ended in 2000.

Several papers discussing the SCAT validation process in our region have been published in recent years (Brody, Stanley, Barnett, Gilheany, Tourón, & Pyryt, 2001; Tourón & Reyero, 2002; Tourón et al., 2005), so we omit any discussion about it here.

Given that no standardized performance tests are used in our country, as we just mentioned, we use the same SCAT test for the ‘in level’ test and for the ‘out of level’ test.

In a standard fashion, we select those students who during the in level stage obtain the results that place them within the top 95 percentile. In order to determine the degree of ability of these students we re-evaluate them with different levels of the SCAT battery and we use the comparison scales in accordance with table 4.
Table 4. SCAT Levels and Norms Used for Out Of Level Testing in Spain

<table>
<thead>
<tr>
<th>Student grade</th>
<th>SCAT for out of level testing</th>
<th>Norms used for out of level comparisons</th>
<th>Number of years difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd Primary</td>
<td>None</td>
<td>6th Primary</td>
<td>2</td>
</tr>
<tr>
<td>4th Primary</td>
<td>Intermediate</td>
<td>6th Primary</td>
<td>2</td>
</tr>
<tr>
<td>5th Primary</td>
<td>Intermediate</td>
<td>7th – 8th Secondary</td>
<td>2–3</td>
</tr>
<tr>
<td>6th Primary</td>
<td>Advanced</td>
<td>8th – 9th Secondary</td>
<td>2–3</td>
</tr>
<tr>
<td>7th Secondary</td>
<td>Advanced</td>
<td>9th – 10th Secondary</td>
<td>2–3</td>
</tr>
<tr>
<td>8th Secondary</td>
<td>Advanced</td>
<td>10th Secondary 11th High School</td>
<td>2–3</td>
</tr>
<tr>
<td>9th Secondary</td>
<td>None</td>
<td>10th Secondary 11th–12th High School</td>
<td>1–3</td>
</tr>
<tr>
<td>10th Secondary</td>
<td>None</td>
<td>11th –12th High School</td>
<td>1–2</td>
</tr>
<tr>
<td>11th High School</td>
<td>None</td>
<td>12th High School</td>
<td>1</td>
</tr>
<tr>
<td>12th High School</td>
<td>None</td>
<td>None</td>
<td>–</td>
</tr>
</tbody>
</table>

As is evident, once the students have exceeded the 95th percentile at the ‘in level’ stage, they are assessed at the battery level shown in the table. There is an exception which is that of the youngest students who are not re-evaluated and whose results in the first stage are directly compared with the norms of students two years older than them.

The rest of the students are assessed at the battery level immediately above that used at the in level stage, but in addition it is important to note that their results are compared with the norms established for students who are between 2 and 3 years older than them. In this manner, we can appreciate the magnitude of their verbal and mathematical ability compared to older students.

Just to illustrate the functioning of the model in Spain we use a set of data from CTY Spain databases that offer us the in level and out of level scores of a group of students assessed along the years in this center.

Figures 2 and 3 display the results of two groups of 142 and 152 Spanish students in 4th to 10th grades (primary and high school) who in the in level measurement processes carried out by CTY in Spain obtained results that, compared to the scales of their age, placed them in the 95th to 99th percentiles.

Let us take a close look at the graphs. Figure 2 shows that the in level results lead to out of level results that show extraordinary dispersion. By way of example, it can be said that the students, who in the first measurement were placed in the 95th percentile obtain, when compared to test norms developed for students 2 or 3 years older than them, percentiles between 34 and 96 in the out level stage. The same effect takes place in all of the in level percentiles with variations that tend to be lower the higher the in level result. We can therefore see that students with a 99th percentile in level can obtain out of level values between 61 and 99, and this is probably leading to a new ceiling effect in the latter.

If we refer to the verbal section of the SCAT shown in figure 3, we can observe the same effect. The students who obtain in level results at the 95th percentile present out of level values between 41 and 95. In the highest extreme, that of students with an in level percentile of 99, the out of level dispersion goes from the 72nd to the 99th percentile. This therefore highlights that the ceiling effect is clearly present in the measurements of levels when the tests are not difficult enough for the most able students. It can be observed that the students who obtain the same in level results are in reality very different to one another and consequently also might have different educational needs that must be taken into account.

These data, although limited by their number, perfectly match those presented in a previous study (Tourón et al., 2005) and follow the line of the series shown previously in relation to the processes followed in the U.S.
As mentioned previously, it is necessary to acknowledge the intellectual differences between the most able students who far from being a homogeneous group, as some have innocently come to believe, present extraordinary differences and very different educational needs.

**Discussion and Implications**

The above data illustrate how the ceiling effects take place with our students, in such a different educational and cultural context, providing us a sort of validation of the “pile up” effect that takes place when the tests are not difficult enough for the most capable students. This should be taken into account in any assessment process disregarding the test or the context. If we want to be able to plan adequate measures to serve differently those who are different, the use of out of level measurements is of paramount importance. Its consequences in talent development appear evident.
The school, the educational system, has to be pro-active and not reactive. This implies that systematic and periodic plans for the identification of the most diverse kinds of talent must be generalised (certainly, and as a priority, academic or intellectual talent, which directly affects the school). Talent that is not identified cannot be fostered and if no educational intervention takes place, it will not develop.

It is imperative to foster specific high performance programs for the most capable students or for students with a degree of talent that requires such. The schools should have a plan in place to assist the most capable students in the same way that they do to assist other specific needs, something that occurs only in some countries.

In addition, attempts should be made to find out the implications of social agents on talent development, in and outside school. The schools play an important role, but it must be understood that special programs will be needed that must be developed in collaboration, but outside of school, with the involvement of specific centers for such, and the collaboration of other highly productive and educational institutions: universities, research centers, technological companies, etc.

It is also essential to provide access to the appropriate programs to those students who need them and avoid some of the negative effects suffered by some students for various reasons. Because the schools act as a gate-keeper many students are not afforded the opportunity to be part of a talent search program.

(...). Programs are too expensive for some students (...). Talent search does a good job for assessing the abilities of children who are already achieving in school. It does not help to identify children who are underachieving or who cannot demonstrate their abilities on the off-level tests because of language differences. (Cf. Olszewski-Kubilius, 2010)

The aim of these practices is to encourage schools to use talent search scores as a vital component of their local programming, to provide education that is truly commensurate with student's abilities" (Seon-Young, Mathews, & Olszewski-Kubilius, 2008, p.57). More research must be carried out into why schools are reluctant to use the talent search data. (cf. Olszewski-Kubilius & Seon-Young, 2005)

All of this strategy cannot and should not be imposed on schools or on the educational system. It must be proposed so that those who wish to join can do so, from the perspective of social initiative and administration and so that it serves as an incentive for others to join.

"Excellence in education is an attainable goal, and at reasonable cost (...). Success will go to those individuals and countries which are swift to adapt, slow to complain and open to change" (Scheleicher, 2007, p. 6).

However, it is true that policies must be developed that facilitate the connection between the Talent Search programs and the schools. As stated by Swiatek (2007), “Use of talent search principles of identification and education in the school setting would enhance the education of even more students than the hundreds of thousands already documented in the impressive record of regional talent searches” (p. 328).

Europe can no longer afford to ignore the need to act proactively to identify and foster talent, precisely its most valuable natural resource. Institutions such as ECHA (European Counsel for High Ability) must play a more active and influential role in the preparation of European policies favouring the most capable. We know how to do it. The research has shown us the way. Now we need to think about how we can make the results obtained have an impact on the educational practise of schools and educational systems in general.

Wasting talent, aside from being unfair to individuals is a luxury that our continent cannot afford. As Professor Stanley said, “Let’s not forget that they need us today. We will need them tomorrow”.

Notes

1 “Competence” is defined by the OCDE as “the combination of skills, knowledge and attitudes that an individual possesses” (OCDE, 2005).

2 Although Talent Search is the name given to refer to the whole identification process that
comprises both the “in level” evaluation as well as the “out of level” evaluation, it is common to find the term Talent Search in literature to refer solely to the second part.

3 Interested reader might visit: http://cty.jhu.edu/ts/tests.html

4 This program is equivalent to the CTY but it is carried out at Duke University.

5 See for further discussion about this point the papers cited in the references list from Ebmaier & Schmulback (1989) and Stanley & Brody (1989) response.

6 It is extremely interesting for the interested reader to review this study that gathers the results of the various cohorts that represent 5,000 students monitored throughout the years. The longitudinal study of the SMPY is the only one of its kind in the world.

7 The SAT was re-centred in 2000 to make the results on the theoretical scale match the empirical results. Moreover, the verbal section has changed in its structure, nevertheless the data presented seem to continue to show the effect that we want to emphasise here.

8 By this, we do not mean to say that only the top 5% should be considered as high ability students because in reality, and taking into account that the abilities that may be considered are very diverse and that the research shows that children can have very different profiles, 5% is one of those myths to be dismissed (see Borland, 2008; Renzulli, 1982).

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References


change in gifted education: The festschrift of Dr. Joyce Van Tassel-Baska (pp. 91–105). Waco, TX: Prufrock Press.


California: Stanford University Press.


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Perfectionism in Chinese Elementary School Students: Validation of the Chinese Adaptive/Maladaptive Perfectionism Scale

Ricci W. Fong and Mantak Yuen

Abstract: Through validation of the Adaptive/Maladaptive Perfectionism Scale (AMPS) (Rice & Preusser, 2002), this study examined the concept of perfectionism among Chinese elementary school students in Hong Kong. A total of 599 students from fourth to sixth grades with ages ranged from 9 to 13 years were recruited on a voluntary basis and with parental consent. They completed a Chinese translation of the AMPS consisting of 27 items. The scale taps into four dimensions of perfectionism, namely: Sensitivity to Mistakes, Contingent Self-Esteem, Compulsiveness, and Need for Admiration. Confirmatory factor analysis was employed. The results supported the AMPS subscales with moderate to high internal consistencies. However, four items were subsequently deleted due to lack of significance. The findings provide methodological and practical implications for future investigations of perfectionism among Chinese students, including those with gifts and talents – a sub-group within which perfectionism is often an issue.

Keywords:
perfectionism, the Adaptive/Maladaptive Perfectionism Scale, Chinese, children, the gifted and talented

Perfectionism can be defined as an individual’s tendency to demand extremely high standards in everything he or she does, with little tolerance for mistakes and a feeling that anything less than perfect is unacceptable (Burns, 1980; Hamachek, 1978). For many years, research has confirmed that perfectionism is evident in some students of high intellectual ability or with special talents (Chan, 2007; Parker, 1997; Siegle & Schuler, 2000; Silverman, 1999; Speirs-Neumeister, 2004). Perfectionism for these students can be either a blessing or a curse. While a modest degree of desire for perfection can positively motivate some students to higher achievement, excessive perfectionism can be detrimental to their psychological and emotional wellbeing (Kottman & Ashby, 2000; Nounopoulos, Ashby, & Gilman, 2006; Silverman 1999). All teachers and personnel concerned with guidance and counseling of gifted students need to be able to investigate the degree and nature of a student’s desire for perfection in cases where this desire may be problematic.

The purpose of this study was to examine the validity of the Adaptive/ Maladaptive Perfectionism Scale (AMPS) (Rice & Preusser, 2002) and the definitions of perfectionism among Chinese primary students. In recent decades, the role that perfectionism plays in students’ development and psychological wellbeing has rapidly gained significance in the research arena. Over the years, the construct of perfectionism has received a myriad of interpretations, giving rise to a proliferation of various tools for measuring perfectionism. Despite the lack of consensus, contemporary research has nevertheless provided ample evidence to support a multidimensional conception of perfectionism (Frost, Marten, Lahart, & Rosenblate, 1990; Hamachek, 1978; Hewitt & Flett, 1991; Slaney, Rice, Mobley, Trippi, & Ashby, 2001; Stoeber & Otto, 2006). Perfectionism can, at times, be an inherently destructive trait (Pacht, 1984) (maladaptive perfectionism), but it also carries a positive aspect which can benefit an individual in various life domains. For example, recent studies suggest that adaptive perfectionism can serve as a catalyst to

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promote positive correlates, such as self-concept (Fong & Yuen, 2009), self-efficacy (Hart, Gilner, Handal, & Gfeller, 1998), subjective well-being (Chan, 2007), life satisfaction (Wang, Yuen, & Slaney, 2009), social relations (Rice, Leever, Christopher, & Porter, 2006), and academic outcomes (Nounopoulos et. al, 2006). Notably, perfectionism is no longer viewed as fixed and unitary but a continuum whereby individuals may, for example, predominantly exhibit adaptive perfectionism while displaying some characteristics of maladaptive perfectionism at a lower intensity. In view of the fact that perfectionistic tendencies can be regulated, and where necessary modified, further investigation of perfectionism is meaningful for counseling and educational purposes (Kottman & Ashby, 2000; Rice & Preusser, 2002; Slaney et al., 2001).

However, despite the growth of perfectionism research, much is still unclear about its conceptualization. Mobley, Slaney and Rice (2005) remarked on a cultural divide in the existing perfectionism studies. As most of the literature to date is based on Western samples, the perception and significance of perfectionism in other cultures are relatively unknown and need to be investigated.

In light of the Confucian values ingrained in Chinese culture, the notion of perfectionism is believed to be particularly relevant to the Chinese population (Wang, Slaney, & Rice, 2007). For example, filial piety, or devotion to parents, has been a fundamental value in the moral codes of Chinese. Confucius noted that filial piety is the basis from which all virtues of humanity, namely benevolence, righteousness, propriety, knowledge and fidelity, are nurtured. It contends that since we receive every part of our body from our parents, we are obliged to obey, respect and glorify our parents, as well as our ancestors, with our accomplishments (Watson, 2007). Just as accomplishments are believed to bring glory, failures would lead to a loss of face (or diu lian) to the whole extended family. It is through this shaming and threats of losing face that Chinese parents often shape their children to adhere to culturally desirable values. In this manner, Chinese children are nurtured to be very sensitive to mistakes and failures. If taken too far, this sensitivity can sow the seeds for maladaptive perfectionism (Fung, Lieber, & Leung, 2003; Yeh & Hwang, 1999; Wang et al., 2007). On the other, Confucianism also emphasizes self-improvement by correcting mistakes, an example of adaptive perfectionism (Watson, 2007). This view is reflected in Confucian sayings, such as, "To make a mistake and not correct it is to make a mistake indeed" or "An exemplary person's errors are like eclipses of the sun or moon. His errors can be seen by all, and when he corrects them, all look up in admiration."

Within the limited body of perfectionism research conducted on Chinese samples, inconclusive findings emerged in terms of the construct and impact of perfectionism (Chan, 2009; Cheng, Chong, & Wong, 1999; Wang et al., 2007; Zi, 2003). Further investigation, with the support of valid and reliable instruments, is thus called for to clarify the meaning, development, and impact of perfectionism in Chinese communities. At present, we have little understanding of perfectionism as it relates to Chinese students within the primary school age range.

**Measurements of Perfectionism**

For many years, the construct of perfectionism has remained controversial. Acknowledging the adaptive facet of perfectionism, Chan (2007) argued that a negative bias is present in the development of most existing perfectionism scales. For instance, the Burns Perfectionism Scale (BPS) (Burns, 1980) was designed based on the Dysfunctional Attitudes Scale (Weissman & Beck, 1978), which taps into dispositions related to clinical depression and anxiety. While the scale's reliability and internal consistency were found to be modest (Hewitt & Dyck, 1986), Enns and Cox (2002) criticized the aspect that the scale has failed to address the constructive and multidimensional nature of perfectionism. Later, taking into account the multidimensionality of perfectionism, Frost et al. (1990) and Hewitt and Flett (1991) devised two perfectionism instruments of the same name, the Multidimensional Perfectionism Scale (MPS). Although Frost et al. (1990) have constructed some new items, the initial 67-item version of Frost MPS was derived primarily from BPS.
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(Burns, 1980) and a measure of obsessionality. The six subscales, namely, Concerns over Mistakes, Organization, Parental Criticism, Parental Expectations, Personal Standards, and Doubts about Actions, focus primarily on measuring the maladaptive dimensions of perfectionism. Likewise, Rice and Preusser (2002) pointed out that the three subscales, namely, Self-Oriented Perfectionism, Other-Oriented Perfection and Socially-Prescribed Perfectionism in Hewitt and Flett's MPS (1991) attempt to tap merely the handicapping features of perfectionism. Taken together, the two MPS scales are developed on the assumption that perfectionism is essentially a negative trait (Slaney, Ashby, & Trippi, 1995).

In the field of clinical psychology, perfectionism remains the first criterion for the diagnosis of obsessive-compulsive personality disorder in the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 2000) although ample empirical findings have supported the existence of its adaptive facet.

Slaney and colleagues (2001) contend that factors identified in the two MPS scales are in fact the resultant effects of perfectionism rather than a description of the concept. To rectify the deficiencies, Slaney and Ashby (1996) and Slaney, Chadha, Mobley, and Kennedy (2000) conducted qualitative studies to explore the definition of perfectionism while attending to its adaptive and maladaptive aspects. The Almost Perfect Scale-Revised (APS-R) (Slaney et al., 2001) was later developed through reliability and factor analyses of responses from 809 undergraduate students in the US. The scale defines perfectionism in terms of one's emphasis on high performance standards (High Standards subscale); one's concern over the discrepancy between the expected standard and actual performance outcome (Discrepancy subscale); and one's emphasis on order (Order subscale). Rice and Slaney (2002) noted that the concept of 'discrepancy' has encapsulated the core nature of maladaptive perfectionism. Three clusters of perfectionists emerged, namely, the adaptive, maladaptive, and the non-perfectionists. Results obtained from other research using the APS-R, as well as Frost's MPS scale, also supported a three-cluster construct (Grzegorek, Slaney, Franze, & Rice, 2004; Mobley et al., 2005; Parker, 1997).

Using different perfectionism instruments, unique constructs of perfectionism are however identified by studies conducted on the Chinese population. Cheng and colleagues (1999) examined the factor structure of a Chinese translation of Frost's MPS scale on 947 Chinese adolescents in Hong Kong. Unlike results generated from the US samples, one of the original six factors, Parental Criticism, was not supported. Later using the APS-R, Wang et al. (2007) yielded a fourth cluster of perfectionists among Chinese college students in Taiwan. The fourth group was constituted by people with low High Standards and high Discrepancy scores. Likewise, in Zi (2003), a fourth group labeled the sub-healthy perfectionists emerged. This group scored as high as the dysfunctional or maladaptive perfectionists on the Parental Criticism and Parental Expectations subscales, and almost as low as the non-perfectionists on the Personal Standards and Organization subscales. More, they scored lower than the dysfunctional perfectionists, yet higher than the healthy and non-perfectionists on the Neurosis subscale of the NEO Five Factor Inventory (NEO-FFI; Yang, 1996). These irregularities in the conception of perfectionism among Chinese could be attributed to their collectivistic backgrounds, the central nature of the family and parents, and the traditional Confucian values (Chan, 2009; Wang et al., 2007). The complexity of perfectionism thus prompts a need for further investigations to capture a clearer picture of the Chinese conception.

To date, the only existing perfectionism measurement that is tailored for Chinese is the Positive and Negative Perfectionism Scale (PNPS-12; Chan, 2007). In line with the adaptive-maladaptive perspective of perfectionism, positive perfectionists are characterized by a realistic striving for excellence; whereas negative perfectionists are rigidly adhered to personal high expectations and are preoccupied with avoiding mistakes. A total of 12 items were constructed with the aid of judgments from teachers of gifted students and pilot testing. The scale includes six items for positive perfectionism and six items for negative perfectionism, each with three self-oriented and three other-oriented items.
Rice and Preusser (2002), however, noted a knowledge gap in the development and perception of perfectionism from childhood to adulthood. Many researchers have suggested salient relationships between perfectionism, familial influence and other personal-social correlates in their investigations on college students (Kawamura, Frost, & Marmatz, 2002; Miller & Vaillancourt, 2007; Speirs-Neumeister, 2004; Nounopoulos et al., 2006; Rice et al., 2006), but few have traced back to examine specifically the conception of perfectionism in primary students. For primary students, the only published instrument available to measure their perfectionistic tendencies is the Adaptive/Maladaptive Perfectionism Scale (AMPS; Rice & Preusser, 2002). In its construction, 27 items were created, stemming from the available perfectionism instruments and theoretical views, as well as with the aid of experts in the field of perfectionism. The validity of the instrument was evaluated using a sample of students from fourth and fifth grades. The items cover four subscales, namely, Sensitivity to Mistakes, Contingent Self-Esteem, Compulsiveness, and Need for Admiration. Internal consistencies of the subscales were high, with alpha coefficients of .91, .86, .87, and .85, respectively. Guided by the hope that a measurement of perfectionism can be developed for future investigations in Chinese primary students, this study attempts to adapt and examine the psychometric properties of a Chinese-translated version of the AMPS in the Hong Kong Chinese primary school context. Secondly, through the validation of the AMPS, and consideration of the students’ responses, the authors also attempt to explore how the concept of perfectionism can be applied to Chinese primary students in comparison to the existing Western construct (Rice & Preusser, 2002).

Method

Participants were 599 students from fourth to sixth grades (320 boys: 279 girls) recruited from two primary schools with a student population comprising different socioeconomic backgrounds and located in separate districts in Hong Kong. Within the total sample, 205 students studied in fourth grade, 192 students in fifth grade, and 202 students in sixth grade. Ages ranged from 9 to 13 years ($M=10.6$, $SD=1.16$). All students were Chinese, with the majority born in Hong Kong (86.6%). Others students were born in Mainland China (8.2%), Canada (2.2%), and other countries (2%).

Letters were sent to the school principals inviting their students to participate. Consent letters were also distributed to parents via the participating schools. Confidentiality, anonymity, and the rights of the participants to withdraw at any point during the study without incurring any consequences were clearly stated.

Participants completed the 27-item questionnaire in the regular classroom setting under teacher supervision. Basic demographic information, including age and grade level, was also obtained through additional items in the questionnaire.

The Adaptive/Maladaptive Perfectionism Scale

The scale consists of 27 items, tapping into four dimensions of perfectionism: Sensitivity to Mistakes – which measures negative emotions triggered by making mistakes (e.g. “I become sad when I see a mistake on my paper.”), Contingent Self-Esteem – which measures positive emotions and self-evaluation based on task performance (e.g. “I feel super when I do well at something.”), Compulsiveness – which measures the attention to order, organization, and task details (e.g. “I always make a list of things and check them off after I do them.”), and Need for Admiration – which measures the need for external approval (e.g. “I do good work so that others think I am great.”). Item responses are rated on a 4-point Likert-like scale, ranging from 1 – really unlike me to 4 – really like me. To ensure the commensurability of the two versions of the questionnaires, items were translated into Chinese and back-translated into English by an academic professor and the researcher. Primary language teachers were also consulted regarding the appropriateness of the translated items for the age level of the students. Further, a pilot
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Results

To examine the model fit of the four-factor construct proposed by Rice and Preusser (2002), confirmatory factor analysis using maximum likelihood estimation was conducted on data from the sample of 599 students using Amos 18. The 27 items were assigned to load on the four originally hypothesized first-order latent variables, namely, Sensitivity to Mistakes, Contingent Self-Esteem, Compulsiveness, and Need for Admiration. In this four-factor model, eight items were constrained to indicate the Sensitivity to Mistakes factor, five items as indicators of the Contingent Self-Esteem factor, six items to indicate the Compulsiveness factor and four items to indicate the Need for Admiration factor.

Chi-square test was applied to aid the decision for the model fit. Since sample size is bound to affect the chi-square statistic in certain circumstances, some of its underlying assumptions may not be met (Bentler, 1990; Bentler & Bonett, 1980; Marsh, Balla, & McDonald, 1988), so other indices of fit were also considered. Hence, the model fit was eventually determined by chi-square test, the Comparative Fit Index (CFI; Bentler, 1990), the standardized root-mean-square residual (SRMR; Bentler, 1995), the root-mean-square error of approximation (RMSEA; Browne & Cudek, 1993), and the 90% confidence interval around the RMSEA. Generally, RMSEA values of less than .08 represent acceptable fit, and values equal or less than .05 indicate good fit (Browne & Cudek, 1993). CFI values of more than .90 and SRMR values of less than or equal to .09 represent an adequate fit (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004).

Table 1 reports that the new 23-item model showed a fair fit for the data, χ²(226, N=599)=597.6, p<.001; SRMR=.09; RMSEA=.05; 90% confidence interval around RMSEA=.05 to .06; CFI=.90. Three items from the Contingent Self-Esteem and one item from the Sensitivity to Mistakes factors were insignificant in the maximum likelihood estimation and were thus deleted from the scale. Data in Table 2 demonstrated that the internal consistency of the resultant 23-item scale was adequate with a coefficient alpha of .80. Cronbach’s coefficient alphas (inter-item correlations) for the Sensitivity to Mistakes, Contingent Self-Esteem, Compulsiveness, and Need for Admiration subscales...
Figure 1. Standardized solution of parameter estimates of the revised Chinese version of the Adaptive/Maladaptive Perfectionism Scale.

were .51 (.259 to .486), .82 (.365 to .599), .69 (.105 to .384), and .83 (.479 to .616), respectively. All 23 items were clear indicators of their respective factor. Structure coefficients ranged from -.43 to .66 for the Sensitivity to Mistakes factor, .57 to .78 for Contingent Self-Esteem, .27 to .65 for Compulsiveness, and .69 to .78 for Need for Admiration (see Figure 1). Correlations between the subscales were also examined (see Table 3).

Discussion

The validation of the AMPS in this study facilitates the future development of perfectionism research in the Chinese primary school context. Through examining the psychometric properties of the Chinese AMPS, we also probed how the concept of perfectionism can be applied to Chinese students. Comparisons of the present findings with those revealed by the previous samples of Caucasian primary students (Rice et. al, 2006; Rice & Preusser, 2002) shed lights on our understanding of the cultural diversity in students’ perception of perfectionism. In view of the prevalence of perfectionism among gifted and talented students, the development of the Chinese AMPS facilitates research along the line of gifted education in Chinese communities. In practice, the availability of a reliable Chinese perfectionism measure also enables timely identification of perfectionistic tendencies among Chinese primary students, particularly the gifted and talented, for more effective intervention.
Results from the CFA showed that the original four dimensions of perfectionism - Sensitivity to Mistakes, Contingent Self-Esteem, Compulsiveness, and Need for Admiration, were not adequately supported in this Chinese sample. With the omission of four items, the resultant scale consists of 23 items. Structure coefficients of all the items ranged from -0.43 to 0.78. Although three out of the four deleted items belonged to the Contingent Self-Esteem subscale, the internal consistency of the subscale remained comparable to that of the original (Rice & Preusser, 2002). Changes in the factor structure could be attributed to contextual factors. In fact, a more drastic change in the Contingent Self-Esteem subscale was observed in Rice et al. (2006). In the study, the AMPS was administered to 145 students in sixth to eighth grades. Corrected item-total correlations were examined to exclude items that did not appear to associate with the presumed subscale and the overall construct of perfectionism. Items were screened out from further analyses if the corrected item-total correlations were less than 0.30. As a result, seven out of eight items from the Contingent Self-Esteem subscale failed to meet the criteria. Rather than the original four-factor model, factor analyses supported only three factors, namely, Sensitivity to Mistakes, Compulsiveness, and Need for Admiration. The only remaining item from the Contingent Self-Esteem subscale loaded on the Sensitivity to Mistakes subscale. Rice and colleagues (2007) attribute the changes in factor structure to the transition of developmental stage and the vagueness in some of the items. In the present research, cultural differences could be an obvious contextual factor that has potentially contributed to the variations.

Notably, the three deleted esteem items were all negatively worded items (e.g. “I do not get excited when I do a good job.”), which may potentially impose psychometric problems, especially when young participants are involved (Marsh, 1986). Previous simulation studies suggest that careless responding to negatively worded items can detrimentally affect CFA results. A separate negative factor emerged when only 10% of the responses were made carelessly (Schmitt & Stults, 1985; Woods, 2006). Marsh (1986) found that negatively worded items were often inappropriately responded to among a sample of second to fifth graders (aged 7 to 10). In particular, responding to negatively worded items appeared to be more problematic to younger participants and those with poorer verbal skills. In this study, although the participants were mostly older than those in the study by Marsh (1986), participants aged 9 (73 students) and 10 (197 students) accounted to 45% of the sample. It is therefore necessary to speculate that 10% or more of these Chinese primary students may have responded to negatively worded items inappropriately or carelessly, which eventually impacted on the factor structure of the subscales. Future research should examine the appropriateness of responses made by Chinese upper primary students to enhance the development of measurements for Chinese children. On the other hand, some students might have difficulties responding to items that demanded a general perspective (e.g. “My work is never done well enough to be praised”) rather than describing a specific example of work in a defined context (e.g. “In mathematics, my work is never done well enough to be praised”). Thus, the lack of specificity of certain items may have diminished the validity and reliability of the students' responses.

In this study, the internal consistencies of the Sensitivity to Mistakes and Compulsiveness subscales were lower, while Contingent Self-Esteem and Need for Admiration were comparable to the findings yielded from the previous US sample (Rice and Preusser, 2002). In fact, mixed findings were yielded in terms of the construct validity and reliability of the Compulsiveness subscale in previous studies. For instance, in Rice et al. (2007), an exceedingly low alpha coefficient was yielded for the Compulsiveness subscale (i.e. .56 for girls and .64 for boys) when the AMPS was administered to a sample of students in sixth to eighth grades. In another study conducted among subjects in fourth and fifth grades, the reliability of the Compulsiveness subscale was found to be remarkably lower when tested among boys, but not girls (Rice, Kubal, and Preusser, 2004). Rice and Preusser (2002) speculate that Compulsiveness could be more bound to contextual factors than the
other dimensions of perfectionism (i.e. Sensitivity to Mistakes, Contingent Self-Esteem and Need for Admiration). It may thus be meaningful for future studies to examine different contextual factors (e.g. community influences) that may contribute to variations in the Compulsiveness subscale.

The low reliability of the Sensitivity to Mistakes subscale in this study is a surprise. The factor has been regarded as a core dimension of perfectionism and a reliable key characteristic of maladaptive perfectionism in most of the existing perfectionism instruments. Its high internal consistency has caused it to be regarded as suitable for screening and diagnostic purposes (Frost, Heimberg, Holt, Mattia, et al., 1993; Parker, 1997; Rice et al., 1998; Rice & Preusser, 2002). Nevertheless, researchers note that what matters most in a measurement is not the internal consistency, but the meaningfulness of the domain in the research and the validity of the measurement (John & Benet-Martinez, 2000; Schmitt, 1996). The present findings suggest that the respective items in the Compulsiveness and Sensitivity to Mistakes subscales may not have adequately illustrated the two relevant dimensions of perfectionism in Chinese students. Future studies should refine the items by using multiple methods, such as interviews and behavioral observations, to better capture the dimensions.

Moreover, Rice and Preusser (2002) suggested that Sensitivity to Mistakes, as an indicator of maladaptive perfectionism, was negatively associated with the other three factors. A different picture was revealed in this Chinese sample. A positive correlation was found among all four factors. This implies that Sensitivity to Mistakes is adaptively perceived by Chinese students along with other adaptive factors (i.e. Contingent Self-Esteem, Compulsiveness, and Need for Admiration). Unlike the Western conception, the present findings reflect that the connotation of failure can, in certain contexts, be positive to Chinese primary students. As the traditional Chinese saying goes, failure is the precedence of success (shi bai nai cheng gong zhi mu), it is possible that Chinese primary students can acknowledge the remedial value of their failures and are less likely to shy away from their mistakes. The phenomenon is also reasonable in light of Confucius' teachings and supports from the wealth of literature on Chinese parenting. Chan (2008) suggests that, among 1041 Hong Kong Chinese students aged 9 to 17, the goal to learn and the goal to prove one's ability are not regarded as independent, but are equally associated with social or familial goals. In the hope of justifying their effort expended, they persistently strive for self-improvement by learning from mistakes. Achieving academically is commonly viewed as the most crucial task among Hong Kong Chinese students (Kashdan and Yuen, 2007), and parental beliefs about students' ability to achieve impact directly on their academic outcomes (Phillipson, 2010).

In summary, the present findings provide support to the construct validity of the AMPS, and in turn, contribute to the future investigation of perfectionism in Chinese primary students. The discrepancies reflected in our findings in comparison to those from previous studies offer insights to researchers and educators in understanding the perfectionistic tendencies of younger students. This research is nevertheless limited by the sole reliance on a single self-report measure (Rice & Preusser, 2002). Item responses could be biased if the participants attempted to make their responses conform to social desirability instead of reporting true personal preferences. Moreover, the single self-report measure may not be able to capture all the dimensions of perfectionism in Chinese primary students. Recalling that previous studies revealed irregularities in the construct of perfectionism in Chinese college students (Wang et al., 2007; Zi, 2003), the present study has provided empirical evidence which adds to the existing literature to suggest that an irregular pattern of perfectionism is also present in Chinese primary students. Researchers should revisit the AMPS by multiple methods to verify its construct validity. Further, cross-cultural studies could be conducted in the future to increase the generalizability of the AMPS. As contended by Wang et al. (2007), the conceptualization of perfectionism may differ among Chinese from different geographical locations and cultures. Primary students in Mainland China, Singapore, and Taiwan may perceive the connotation of perfectionism differently...
Due to the variation in living environment, social values, and educational system. More research effort is warranted to better define the conceptualization of Chinese perfectionism from a holistic perspective, as well as to increase the validity of the AMPS for research and practical uses.

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**References**


Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis:


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How Giftedness Coexists with Learning Disabilities: Understanding Gifted Students with Learning Disabilities (GLD) in an Integrated Model of Human Abilities

Kwang-Han Song1* and Marion Porath1

Abstract: This paper proposes a model to explain the characteristics of gifted students with learning disabilities (GLD) in terms of general and domain-specific aspects of intelligence. A three-step conceptual analysis was used to interpret literature on GLD through categorization of characteristics, comparison and evaluation of these characteristics in light of relevant intelligence theories, and integration of the characteristics into a proposed model. The model suggests that general abilities can be limited by weak domain memory resulting in domain-specific disability. Because of its specification of functional interrelationships between general intelligence, memory, and domain-specific abilities which are uniquely divided into content and representation sub-domains, the model is a unique explanatory framework for dual exceptionality.

Keywords: Integrated model, cognitive mechanism, gifted learning disabled, general abilities, domain memory, abilities of GLD

There is little doubt that some students who are gifted also have learning disabilities (GLD). While they display exceptional or creative thinking (Baum, Owen, & Dixon, 1991; Brody & Mills, 1997), they also exhibit weak memory and perception (Hulme, 1992; Siegel, 2003; Wong, 2004), distractibility (Baum, 1998; Baum et al.), and off-task behavior (Baum, 1990; Beckley, 1998). Thus, the term GLD refers to those students who have superior intellectual ability but exhibit a significant discrepancy in a particular academic area such as reading, writing, or mathematics (McCoach, Kehle, Bray, & Siegle, 2001). Although GLD students show variability in their cognitive profiles, characteristic profiles include different forms of disparity between auditory and visual facility (Munro, 2002). Some GLD students show higher visual abilities than verbal abilities (Brody & Mills, 1997; Silverman, 1989a) with high performance in spatial puzzles, tracing mazes, duplicating block designs, counting three dimensional arrays of blocks, visual transformation, and mental rotations. They are also more likely to use global rather than analytic sequential learning strategies and learn in an all-or-nothing fashion rather than in a stepwise incremental way. Others demonstrate higher verbal than nonverbal abilities, including strong listening comprehension and extensive vocabularies.

Giftedness in coexistence with learning deficits is often conceived of as paradoxical or even impossible. However, when intelligence is viewed as multidimensional (e.g., Gardner, 1983; 1999; Renzulli, 1978; Sternberg, 1988), GLD is less of a puzzle (Liddle & Porath, 2002). Still, a multidimensional perspective on giftedness does not fully explain GLD. Specific domains of intelligence are not defined in terms of cognitive processes but

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rather on performances that appear in various social and cultural contexts, making it difficult to understand the processing limitations that may underlie GLD. For example, Sternberg (1988), who studies general cognitive processes (i.e., metacomponents and reasoning) and suggests multiple abilities or intelligences, does not provide any criteria for domains in terms of cognitive processes. Similarly, the proliferation of “intelligences” following Gardner (1983) did not specify how those intelligences are independent of and/or related to other abilities or intelligences, including general intelligence, or $g$. Some researchers argue that they cannot be independent (Klein, 1997; Morgan, 1996). Dance is both musical and physical; conversation is both linguistic and interpersonal; and solving a physics problem requires both spatial and logical-mathematical abilities (Klein, 1997).

An integrated model of human abilities (Song & Porath, 2005) hypothesized how general and multiple intelligences may be related and function domain-specifically. The model constituted a rethinking of interrelationships between abilities proposed by major models of intelligence (Carroll, 1993; Case, 1985; Case, Demetriou, Platsidou, & Kazi, 2001; Gardner, 1983; Sternberg, 1988). These models of intelligence were ‘rebuilt’ in an unique way to explain giftedness via a cognitive mechanism that accounts for how domain-specific knowledge is formed, as well as which abilities are general and domain-specific cognitive characteristics of giftedness. However, the model has not been conceptually or empirically tested. This paper addresses a conceptual analysis of GLD as a conceptual test of the model. Given the considerable agreement that the mind has conceptual capabilities that are general, as well as those that are specific (Carroll, 1993; Case, 1992; Demetriou, 2002), there may be cognitive abilities general to all gifted individuals and domain-specific cognitive abilities unique to specific groups of gifted individuals such as GLD.

**An Integrated Model of Human Abilities**

Our world is full of many stimuli that provoke thought, and these stimuli are related to specific domains such as practical, social, and idealistic stimuli in terms of content and auditory and visual stimuli in terms of representation. Humans find relationships between domain stimuli and these found relationships result in connected stimuli in memory; these connected stimuli form domain knowledge. The ability to find relationships and form knowledge is defined as general intelligence ($g$). While finding relationships, an individual plans and controls his/her thinking processes (executive abilities; Demetriou, 2002; Sternberg, 1988) on one hand, and processes information (processing abilities; Sternberg, 1988) on the other. Executive and processing abilities are instrumental to $g$; $g$, executive, and processing abilities are defined as general abilities (Figure 1). When an individual is stimulated by internal or external demands, he or she may activate executive and processing functions to find relationships between stimuli (“activation” of cognitive functions; Figure 1).

General abilities appear as domain-specific abilities when they are engaged with domain stimuli. For example, when $g$ is engaged with practical stimuli, it appears as practical intelligence. When $g$ is engaged with linguistic stimuli, it appears as linguistic intelligence. Accordingly, sensory stimuli, which are connected and formed in thinking through general abilities to become domain knowledge, determine domains.

Short-term memory, or mental space, is the workplace for processing (Case, 1985; Halford, Mayberry, O’Hare, & Grant, 1994). Two mental spaces are suggested (i.e., auditory and visual; Gardner, 1983; Winner, 1996) – the phonological loop that is specialized for the retention of verbal information (i.e., phonological store) and the visual-spatial sketchpad that is specialized for the processing and storage of visual stimuli (Baddeley & Logie, 1999). In the model, domain memory contains the material that is processed and connected through relationships.
The integrated model defines domains in terms of context and representation because domains involve both. Content refers to entities (stimuli level) or ideas (knowledge level), whereas representation refers to the form in which content is represented (i.e., symbolization; Alexander, 1967; Gardner, 1983; Figure 2).

The model suggests two content domains identified from abilities or intelligences suggested by major models of intelligence: practical (Sternberg, 1988), and social (Case, 1992; Gardner, 1983; Sternberg, 1988). A third – idealistic – was added to complement the first two (Song, 2004; Song & Porath, 2005) since gifted students also demonstrate exceptional levels of idealism (Clark, 2002; Silverman et al., 1986; Tuttle, 1983). Practical intelligence is related to daily material entities or adaptation to new cultures; social intelligence to human minds (i.e., mental entities) or knowledge of human mental states; and idealistic abilities to rule systems or sense of justice or fairness (i.e., idealistic ideas).

The model suggests linguistic, mathematical, spatial, auditory, visual, taste-olfactory, and tactile domains as ways of representing knowledge (representation domains). Linguistic, mathematical, spatial, auditory, and visual representation domains were suggested by major models of intelligence (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983: Sternberg, 1988). Song (2004) added taste-olfactory and tactile stimuli. Individual sensory stimuli are basic and independent (e.g., an auditory sound, a visual symbol); however, when information is processed, it is rare that stimuli are considered independently. Multiple domain stimuli are usually processed and connected, resulting in an integrated representation. In the linguistic domain, for instance, auditory and visual domain stimuli are connected because language is both phonological or verbal (i.e., auditory) and written (i.e., visual).
Figure 2. Representation of content through auditory, visual or auditory-visual means.

In the integrated model, cognitive processing precedes appearance of domain products or performances in social contexts. Gifted students may show practical-, idealistic-, and/or social-relevant abilities when they engage with the content of those domains, and auditory-, visual-, taste-olfactory-, and/or tactile-relevant abilities when they represent their abilities. These representations may be either independent (e.g., purely visual artistic) or integrated (e.g., phonological-written).

**Method**

A conceptual analysis was used to discover interrelationships between abilities (Song, 2004) as a test of the integrated model. The analysis is a constructivist methodology that involves three cognitive steps informed by theories of development (Case, 1985), general intelligence (Carroll, 1993; Case et al., 2001), and domain-specific cognitive abilities (Gardner, 1983; Sternberg, 1988). This approach recognizes the importance of using theoretical literature to ensure clarity when probing relationships between concepts (Henwood & Pidgeon, 2003).

- **Step 1 Identification:** Cognitive abilities of GLD students were identified from those in the literature on GLD and classified into categories based on the attributes of the cognitive abilities.
- **Step 2 Comparison and evaluation:** Abilities were compared and evaluated in light of theory.
- **Step 3 Integration:** The abilities of GLD students, which were compared and evaluated in the previous steps, were connected through relationships found from the analysis informed by theory.

Silverman’s (1989a; 1989b) list of abilities of GLD students was used to define primary cognitive abilities. Her collection represents the majority of abilities identified by various individual researchers (Baum et al., 1991; Bireley et al., 1992; Brody & Mills, 1997; Klein, 1980; Rivera, Murdock, & Sexton, 1985; Suter & Wolf, 1987). The cognitive abilities were coded according to apparent commonalities among them, resulting in five categories (Table 1).
Table 1. Cognitive Abilities of Gifted Students with Learning Disabilities

<table>
<thead>
<tr>
<th>Categories</th>
<th>Strengths</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thought Processes</td>
<td>• Creative thinking ability</td>
<td>• Struggles with sequential material</td>
</tr>
<tr>
<td></td>
<td>• High abstract-reasoning ability</td>
<td>• May fail at subjects emphasizing sequencing</td>
</tr>
<tr>
<td></td>
<td>• Unusual imagination</td>
<td>• Performs poorly on timed tests</td>
</tr>
<tr>
<td></td>
<td>• Understanding of complex relations and systems</td>
<td>• Emotions can overpower reasoning</td>
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<tr>
<td></td>
<td>• Good problem-finding skill</td>
<td>• May be unable to learn unless interested</td>
</tr>
<tr>
<td></td>
<td>• Astute questioning ability</td>
<td>• Hopelessly disorganized</td>
</tr>
<tr>
<td></td>
<td>• Penetrating insights</td>
<td>• Finds clever ways to avoid weak areas*</td>
</tr>
<tr>
<td></td>
<td>• Highly developed intuition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Finds clever ways to avoid weak areas*</td>
<td></td>
</tr>
<tr>
<td>Attention and</td>
<td>• Keen visual memory</td>
<td>• Poor auditory memory</td>
</tr>
<tr>
<td>Memory</td>
<td></td>
<td>• Poor short-term memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Difficulty with rote memorization</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Often inattentive in class</td>
</tr>
<tr>
<td>Language</td>
<td>• Sophisticated sense of humor</td>
<td>• May fail at subjects emphasizing memory</td>
</tr>
<tr>
<td></td>
<td>• Grasp of metaphors, analogies, satires</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sophisticated oral vocabulary</td>
<td></td>
</tr>
<tr>
<td>Maths</td>
<td>• Excellence at mathematical reasoning</td>
<td>• Poor computation</td>
</tr>
<tr>
<td>Spatial</td>
<td>• Early ability in puzzles and mazes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Exceptional ability in geometry and science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Possible artistic talent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Possible mechanical aptitude</td>
<td></td>
</tr>
</tbody>
</table>

Note. *Ability may be considered a strength or weakness depending on the situation.

Results

General Abilities of GLD Students

Thought Processes. GLD students' abilities in the thought processes category may be explained by theories suggesting g, reasoning (Carroll, 1993), or processing efficacy (Case et al., 2001) as general abilities. However, where abilities are associated with a deficit in processing (e.g., high abstract reasoning but poor sequential processing) these mixed profiles may be explained better by multiple intelligence theories because these argue for domain-specific intelligences and processing. Based on multiple intelligence theories, GLD students may have high intelligence related to abstract processing but low intelligence related to sequential processing. However, these theories do not specify which intelligences are related to abstract processing and sequential processing, respectively.
Other abilities such as 'creative thinking, unusual imagination, understanding of complex relations and systems, good problem solving, penetrating insights, and highly developed intuition' may not be explained well by $g$ or multiple intelligence theories. The identity of $g$ is not known (Demetriou, 2002), thus the abilities that can be explained by $g$ are not known. Likewise, it is not clear which of the multiple intelligences explain these abilities.

The integrated model may explain the abilities in the thought processes category better than the theories that informed it because the model specifies the function of $g$ and other general abilities based on interrelationships between abilities. The integrated model suggests that $g$ is the ability to find relationships between stimuli and form knowledge. Thus, the ability of 'understanding of complex relations and systems' may be directly explained by $g$. According to the model, when the ability to find relationships ($g$) is disabled, a student cannot be gifted due to an inability to discover the relationships that are foundational to knowledge. However, this is not the case with GLD students; they understand complex relations and systems.

$G$ may also help to explain the abilities of creative thinking, unusual imagination, good problem solving, penetrating insights, and highly developed intuition. These abilities are not limited to specific domains. Given that they are abilities of giftedness (Baum et al., 1991; Brody & Mills, 1997; Song & Porath, 2005), they may be related to $g$ in the discovery of relationships (e.g., created, imagined, intuited relationships). Considering that the model suggests that $g$ appears in domains, the fact that GLD students may show high visual memory but poor auditory memory suggests that $g$-related abilities may appear in visual or visual-related domains in which keen visual memory and processing are required. Creativity and problem solving exists in any domain. Intuition and insights may be more prevalent in those with "visual minds" or may be derived from spatial models (Gardner, 1983).

The mixed profiles of 'high abstract reasoning, struggle with sequential material, may fail at subjects emphasizing sequencing, and perform poorly on timed tests' may also be explained better by the integrated model than the theories that informed it. The ability of 'high abstract reasoning' may appear in domains in which abstract stimuli are processed in order to find relationships between them and form abstract knowledge, that is, idealistic domains in which abstract content is connected. The disabilities related to poor sequential processing may appear in domains such as language or math that require auditory-sequential memory and processing. Reading, spelling, rote memorization and computation (or numeracy) require auditory and/or sequential ability (Bender, 2001; Cawley, Fitzmaurice, Shaw, Kahn, & Bates, 1979; Gardner, 1983; Jordan, Levine, & Huttenlocher, 1996; Munro, 2002; Silverman, 1989a; 1989b; 1993).

According to the model, if processing ability is disabled in an individual, he/she cannot be gifted because relationships are fundamental to knowledge formation. The fact that GLD students show high ability in abstract reasoning suggests that they are not disabled in processing despite their poor sequential processing.

Abilities of GLD students may not be fully understood through the perspective of representation domains only; GLD students who are poor at linguistic thinking may show a gifted level of idealistic domain knowledge, which may be formed in other ways (e.g., visual thinking). However, the theories that informed the model do not specify domains in terms of both content and representation nor do they specify a cognitive mechanism for processing content and representation stimuli. They focus only on representation (e.g., verbal, linguistic, mathematical, spatial); these abilities may not explain fully why GLD students show 'high abstract reasoning and keen visual memory but poor sequential processing and poor auditory memory.'

The abilities of GLD students may be better explained by the integrated model; it suggests that content is represented by, and processed with, representational stimuli. Abstract reasoning may refer to a cognitive activity in which abstract content is visually
processed in order to find relationships. Likewise, auditory representation may be used to process content associated with practical domain stimuli. Considering the two contrasting representations, verbal or visual (Munro, 2002; Wechsler, 1992), if visual stimuli are preferred to represent abstract content, auditory stimuli may be preferred to represent practical content. The fact that GLD students may show keen visual memory but poor auditory memory suggests that the disparity between abstract and sequential processing may result from the difference between visual and auditory memory. Deficits in auditory memory and processing but strengths in visual memory and processing are characteristic of GLD students (Baum & Owen, 1988; Bireley et al., 1992; Silverman, 1989a; 1989b).

It is suggested that the fact that a GLD student 'may be unable to learn unless interested' may be explained by the disparity between domain abilities. They may find ways to avoid weak areas because they already have domains in which they are interested and can show high abilities. Their 'hopeless disorganization' may be shown when they pay little attention to their surroundings due to their intrinsic motivation for high visual imagination (or creative thought) or when they are engaged in linguistic activities (e.g., listening or writing) that require high auditory-sequential abilities.

In the relationship between content and representation, practical intelligence, the ability to adapt to new environments, is closely related to speech function (Sternberg, 1988; Vygotsky, 1978). Auditory representation is used practically in real life situations (e.g., successful adaptation to new cultures, and verbal communication; Sternberg & Grigorenko, 2004). Students gifted in practical domains may prefer to deal with aspects of life and ideas in the material world, showing their giftedness in natural sciences such as chemistry and acoustics, or social sciences such as economics. They may have high potential for auditory domain performance.

The connection between idealistic thoughts and visual thinking is demonstrated in mathematicians whose gift is nonlinguistic representation and a love of dealing with abstraction. Mathematical reasoning is done through holistic or spatial processing rather than linguistic sequential processing (Gardner, 1983). “Visual-spatially gifted learners” (Silverman, 1989b, p. 15) are characterized by idealistic thinking; they display personally complex rule systems; dominance over peers; concern for morality, justice, fairness, and global issues; and superiority in class discussions (Munro, 2002; Rogers & Silverman, 1998; Silverman, 1989a; 1989b).

Students gifted in leadership also demonstrate these abilities (Cattell, Cattell, & Johns, 1984). Leadership and spatial abilities have a strong correlation (Skinner, 1981).

Gifted students in idealistic domains may be interested in abstract entities (e.g., rule systems, space, or energy) and visual representations, and think about abstract ideas (e.g., ideals for behavior and society such as fairness or justice). Thus, ideistically gifted individuals may exhibit their giftedness in natural sciences such as physics, cosmology, and optics, or social sciences such as law, politics or ethics. They may also have high potential and visual-related domain performance (e.g., art, architecture, or sculpture).

Even though abilities related to the social domain were not found, social thought may be represented by both auditory and visual domain stimuli because human mental states can be recognized either by auditory stimuli such as vocal tones or by visual stimuli such as facial expressions, both of which are frequently employed as tools to recognize mental states (Ekman, 1994; Russell, 1995).

**Attention and Memory.** Neither g nor multiple intelligence theory specify how attention affects or is related to other cognitive components. The integrated model hypothesizes functional interrelationships between cognitive components. Attention works in concert with executive functioning (Barkley, 1996) as well as working memory (Cherkes-Julkowski, Sharp, & Stolzenberg, 1997) and, thus, problems with attention can result in widespread difficulties (Zera & Lucian, 2001). Interrupted executive or processing
functions may appear as disinhibition, causing difficulties in concentration on specific tasks or learning, which may appear as distractibility.

GLD students show rapid learning of high interest material (Baum, 1984; Schiff, Kaufman, & Kaufman, 1981; Whitmore, 1980) and intensity and commitment to self-selected work in nonacademic settings (Baum, Renzulli, & Hebert, 1995; Reis, 1998; Weiner, 1992). This suggests that they do not show disabilities in attention in domains in which they are interested.

**Domain-Specific Abilities of GLD Students**

**Language.** GLD students show both strengths and weaknesses in language-related abilities: They show ‘sophisticated sense of humor, grasp of metaphors, analogies, satire, and sophisticated oral vocabulary’ but also weaknesses in listening-, reading-, and writing-related abilities. GLD students’ strengths may be explained by high verbal-linguistic ability; poor writing-related and reading-related abilities may be explained by poor verbal-linguistic ability. That is, strong and weak verbal-linguistic abilities may co-occur in GLD students. However, this co-occurrence is not easily understood.

The integrated model may help to explain these seemingly contradictory abilities through specifying a between-domain contributing ratio. Domains are formed in an independent or integrated manner from two fundamental domain stimuli: auditory and visual representation. Most domains integrate these stimuli in different ratios. For example, linguistic activities require both auditory and visual memory and processing, although the contributing ratio of each may vary depending on the activity. The ability, ‘grasp of metaphors, analogies, and satire’, may be explained by GLD students’ high visual memory and processing. Metaphoric ability, which is highly correlated with analogical ability, is a hallmark of the visual-spatial reasoning aspect of logical-mathematical intelligence (Gardner, 1983).

‘Sophisticated sense of humor’ may also be more related to visual memory and processing than auditory memory and processing. Humor is a performance of high g, but its formation may be different depending on domain preference in terms of representation. For GLD students who have keen visual memory but poor auditory memory, their humor may be formed visually rather than verbally, and represented verbally later. Humor develops with visual-spatial ability in children (e.g., pattern recognition; Clarke, 2008).

**Mathematics.** GLD students may show excellence at mathematical reasoning but poor computation. Math is a domain in which auditory and visual domains are integrated. Some mathematical performances may require more auditory than visual domain functions, and others may require the opposite pattern. GLD students who show excellent mathematical reasoning but poor computation may have a disparity between their visual and auditory memory and processing. Their high visual memory and processing may enable them to do excellent mathematical reasoning, but their poor auditory memory and processing may limit their computation in math. Math requires visual-spatial abilities such as geometric skills (Ackerman, Anhalt, & Dykman, 1986), and numeracy requires auditory-sequential abilities (Bender, 2001; Cawley et al., 1979; Jordan et al., 1996). Mathematical reasoning is more than computation and can be carried out intuitively or visually in a holistic manner, without relying on linguistic sequential steps (Gardner, 1983).

**Spatial Ability.** GLD students show strengths such as ‘early ability in puzzles and mazes, exceptional ability in geometry and science, possible artistic talent and mechanical aptitude’ which may be explained by high spatial ability (Carroll, 1993; Case, 1985; Case et al., 2001; Gardner, 1983). GLD students may show ‘excellent’ ability in geometry and science but ‘possible’ artistic talent and mechanical aptitude. That is, different levels of abilities in spatial-related performances may exist in GLD students. The integrated model considers spatial ability as different from language and math domains. Spatial
performance or knowledge is related to the visual domain, whereas language and math are domains in which auditory and visual domains are integrated.

‘Exceptional ability in science’ may be observed when GLD students are engaged with science content or performances that require high visual-spatial abilities (e.g., observation, discovery, and mental imagination). Einstein said, “The words of the language, as they are written and spoken, do not seem to play any role in my mechanism of thought” (Gardner, 1983, p. 190).

The abilities of ‘possible artistic talent and mechanical aptitude’ may be explained by GLD students’ keen visual memory and processing. The centrality of spatial thinking in the visual arts is self-evident; artistically gifted students have exceptional visual memory (Winner, 1996). The relationship between mechanical ability and visual-spatial ability has been noted (Anderson, Meyer, & Olivier, 2001).

**Discussion and Implications**

This study provides a new perspective on understanding the co-occurrence of giftedness with learning disabilities. GLD students may show large discrepancies between practical, social, and idealistic domains in content, and between auditory and visual representation. However, their strengths can, and should prevail.

Given that intelligence (g) is hypothesized to function domain-specifically, it is necessary to question the present concept of disability. The present term “learning disabilities” may stem from a perspective of g as linguistic or mathematical intelligence predominantly used and emphasized in school learning.

Instead of GLD, the term, Giftedness in Domains (GD), is suggested to support a broad conceptualization of intelligence or different ways of being intelligent. Considering that a single general intelligence that appears as multiple intelligences in various academic, social, or natural contexts is hypothesized, GD is a reasonable suggestion. Different types of GD may be hypothesized as follows.

If a gifted person has less auditory then visual mental space (weak auditory memory vs. strong visual memory; Figure 3), less attention is directed to the auditory mental space (auditory internal attention deficit), resulting in poor auditory processing (auditory disinhibition or distractibility) and accordingly poor auditory learning and achievement. He/she may be identified as LD in auditory domains and may show difficulty in auditory (e.g., listening) and auditory-predominant domains that require more auditory-sequential memory, attention and processing (e.g., phonological reading and writing). However, relatively more attention is directed to the visual mental space (strong visual internal attention), resulting in high visual processing (visual inhibition and concentration) and, accordingly, high visual learning and achievement. High facility and abilities in visual (e.g., visual arts, geometry) and visual-predominant (e.g., math, science) domains in terms of representation and idealistic or/and social domains in content may be demonstrated.

Einstein, who is considered as GLD (Fetzer, 2000), may be a good example. Einstein, one of the geniuses in the history of science, had serious problems with language, whereas he showed high interest in space and light, and world peace (Brian, 2005). He worked in physics, a field that deals with abstract entities (e.g., space, energy) and visual stimuli (e.g., light). The reason that more gifted individuals with LD in auditory domains have been known as great achievers in history may lie in their giftedness in idealistic and visual domains that contributed to a high level of abstract knowledge or creation of visual artifacts.

A gifted individual who has small visual mental space but large auditory mental space (weak visual memory vs. weak auditory memory; Figure 4) may show the opposite cognitive profile to the previous example. He/she may be identified as LD in visual
domains and may struggle in visual and visual-predominant domain learning but show high abilities in auditory and auditory-predominant domains in terms of representation and practical or/social domains in content. Finally, if a gifted individual has equally small auditory and visual mental spaces (Figure 5), little attention is directed to these spaces (auditory and visual internal attention deficit), resulting in poor auditory and visual processing (auditory and visual disinhibition or distractability) and, accordingly, poor auditory and visual learning in an independent or integrated manner. He/she may be identified as LD in auditory and visual domains and show difficulties in most auditory and/or visual domains but may demonstrate high abilities in non-sensory domains (e.g., spiritual), which cannot be sensed through human sensory organs (Roeper, 2008).

In identification, gifted students with learning disabilities should be identified by weak auditory or/and visual memory with high $g$, the ability to deal with relationships. Short-term memory and $g$ need to be measured separately. Otherwise, GLD students may not appear to be LD, compared to their LD peers with average $g$ because abilities and disabilities mask each other (Brody & Mills, 1997). Considering that the size of mental space (or strength of memory) is quantitative, the meaning of ‘weak memory’ is relative; it can be socially decided (e.g., 1–5% from the bottom). This way of identification is different from present ones based on discrepancy between IQ and achievement.
General and Domain-Specific Abilities of GLD Students

(Emrick, 1992; Kavale & Forness, 2000; Rimm, 1997) or between pre- and post-intervention levels of performance (Gresham, 2001). It is simpler than the assessment and educational implications of a discrepancy perspective. In terms of giftedness, this study implies that giftedness is related to relationships in knowledge itself, not representation (e.g., linguistic, mathematical, musical, artistic) and has more to do with finding new relationships than learned relationships. Gifted students may be highly motivated to form discovered or creative domain knowledge by inference (Song, 2009; Song & Porath, 2005). This means that GLD students are gifted in finding relationships in knowledge and may be highly creative in doing so. Gifted students with LD in specific domains (Figures 3–5) can show high learning abilities in domains other than those emphasized in school. For example, in representation, even though they may show disabilities in auditory (e.g., listening) and auditory-predominant (e.g., phonological reading and writing) domains, the first group of gifted students may show high abilities in visual (e.g., visual arts) and visual-predominant domains (e.g., math, science). Furthermore, they also can be gifted in idealistic or/and social domains. They may form a gifted level of knowledge in those domains through visual learning, real experience (e.g., observation, experiment), or inference. This study suggests that gifted students must be provided with a variety of ways of learning to realize their giftedness to the fullest.

The abilities of GLD students may be explained better by the integrated model than by the theories that informed it. The integrated model specifies g based on interrelationships between abilities suggested by the theories; how g is related to domains or domain abilities; and how various domains are formed through processing of independent domain stimuli in terms of content and representation. Abilities related to thought processes and attention and memory may be explained by general abilities including g “working” in mental space. Different contributing auditory and visual ratios in integrated domains may explain domain-specific abilities.

Despite its contribution and implications, this study has two shortcomings. One is that the abilities dealt with in this study may not represent all types of learning disabilities. The GLD students represent those reflected in extant literature on GLD, that is, those who show high ability in spatial or spatial-related domains but poor ability in verbal or verbal-related domains (i.e., verbal GLD type). The second is that GLD students’ practical thoughts are limited to speculation about the relation between practical thought and auditory representation; GLD students with poor auditory memory are considered practically disabled. Whether GLD students are socially gifted or disabled cannot be known from this study due to the lack of related abilities reported in the literature.

Future research should examine the practical, social, and idealistic abilities of gifted students with LD in visual domains or those with LD in both auditory and visual domains in order to articulate the relationships between abilities to deal with representation and content. In addition, considering that the integrated model has only been conceptually tested, it needs to be developed by empirical tests; initial models may change or evolve gradually as they are tested empirically.

References


Baum, S. (1984). Meeting the needs of learning


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Teachers' Judgments of Elementary Students' Ability, Creativity and Task Commitment

Detlef Urhahne

Abstract: The three-ring model of giftedness by Renzulli is one of the most popular theoretical concepts in giftedness research. It proposes that gifted students should show above-average abilities, creativity, and task commitment. A research study with 144 elementary students and their eight class teachers examined the accuracy of teachers' judgments of students' three-ring competencies. Ability and creativity of the students were assessed by standardized testing procedures, whereas task commitment was measured by a self-descriptive questionnaire. Teachers were asked to judge students' competencies on rating scales. Research results show that teachers were accurate judges of student abilities, but had difficulty predicting students' creativity and task commitment. Teachers' effectiveness and efficiency in selecting the most qualified students was low. Teachers detected only half of the students with the highest competencies and nominated many more students to be gifted than actually were in the sample. In conclusion, teachers are only accurate judges of student performance but cannot correctly assess students' creativity and task commitment.

Keywords:
Accuracy of teacher judgment, three-ring model of giftedness, mathematics ability, creativity, task commitment

Teachers' subjective ratings of students' abilities, attitudes, and traits are of particular importance for the appropriate selection and promotion of gifted individuals. Quite often teachers are asked to nominate the most intelligent and achievement-oriented students of their class before more formal testing procedures are applied (Neber, 2004; Schack & Starko, 1990; Sommer, Fink, & Neubauer, 2008). Wrong decisions in the preselection phase can exclude gifted students from special educational programs that they actually deserve to be in. This research study aims to examine the accuracy of teachers' judgments of students' talents in relation to the three-ring model of giftedness (Renzulli, 1978, 2005). Renzulli (2005) based his conception of giftedness on three interlocking clusters of traits: above-average although not necessarily superior intellectual abilities, high levels of creativity and high levels of task commitment. These three clusters are of equal importance in contributing to giftedness and build a solid theoretical basis to evaluate teachers' abilities in identifying students of high performance potential.

The Three-Ring Model of Giftedness

In the past, a large variety of definitions and models of giftedness have been developed (Sternberg & Davidson, 2005). However, most of the early theoretical approaches simply equated giftedness with high intelligence (Stoeger, 2009). In contrast, Renzulli (1978) suggested a multidimensional, but still rather clear model of giftedness consisting of the three factors of ability, creativity, and task commitment. He sets the stage for more modern, multidimensional models, which are nowadays favored in giftedness research (Gagné, 2005; Heller, Perleith, & Lim, 2005; Sternberg, 2005). Renzulli (2005) made the important distinction between “schoolhouse giftedness” on one hand and “creative-
productive giftedness” on the other hand. Schoolhouse giftedness manifests itself in the test-taking and lesson-learning abilities of the students that help to get high grades in school. This kind of giftedness can be easily measured by IQ or other cognitive ability tests, but, according to Renzulli (1978), this is not sufficient to draw a complete picture of giftedness. In the past, he argues, that not the best test-takers or lesson-learners were remembered but those who have applied their knowledge and created something original and unique. This creative-productive giftedness is decisive for the development and economical growth of a society. It is essential in real-world problem situations where original thoughts, solutions, materials and products are urgently required. Creative-productive giftedness does only partly depend on high cognitive abilities. Of equal importance in producing innovative outcomes are people’s creativity and their motivation for a task. Renzulli (2005) therefore believes that a combination of three interacting clusters of traits, namely above-average abilities, creativity, and task commitment, is more suitable to illustrate the main dimensions of human potential for creative productivity.

Above-average abilities can appear as general or specific abilities. These abilities can either be measured by general aptitude or intelligence tests, or by achievement tests or tests of specific aptitude, e.g., in mathematics. As the best test-takers are not necessarily the best creative-productive persons in later life, Renzulli (2005) recommends using just above-average abilities as a more adequate selection criterion. Especially for highly creative and productive accomplishments, other variables apart from general or specific abilities become increasingly important. That is why Renzulli (2005) regards not the highest, but above-average abilities to be sufficient to develop an extraordinary talent in a specific area.

Creativity is strongly related to giftedness. A highly creative person can also be denoted as gifted. Accordingly, Renzulli (2005) integrates creativity as a second component in his three-ring giftedness model. Creativity can be differentiated from intelligence by the involved thinking processes (Runco, 2007). Processes of divergent thinking are necessary to come up with creative ideas, whereas processes of convergent thinking lead to the correct answers in intelligence tests. Creativity is hard to measure, and Renzulli (2005) doubts the validity of divergent thinking tests, as the relationship between divergent thinking and creative performance criteria is limited. At the moment, there is still a lack of reliable and valid creativity measures that help to predict future creative-productive giftedness.

Task commitment is the third component of the three-ring conception of giftedness. Renzulli (1978) uses the expression task commitment to describe the perseverance, endurance, hard work, and dedicated practice of a person to carry out actions in one’s area of interest. He perceives task commitment as a more specific term than motivation as it is brought to a particular problem or a specific performance area. The longitudinal studies of Lewis Terman have revealed that personality factors and not intelligence make all the difference between the most successful and the least successful gifted subjects. Most important in Terman’s studies were traits like persistence in the accomplishment of goals, integration toward goals, self-confidence, and freedom from inferiority feelings (Terman & Oden, 1989). Unfortunately, Renzulli’s term task commitment has not taken root in motivation psychology, and he never developed an instrument to measure it. Nowadays, motivation concepts like mastery goal orientation (Dweck, 1986, 1999) or effort regulation (Pintrich, Marx, & Boyle, 1993; VanderStoep & Pintrich, 2002) might be used to catch the meaning of task commitment.

The Accuracy of Teacher Judgment

The ability to accurately assess student characteristics is considered to be an important professional skill of teachers. In general, it can be stated that teachers are appropriate judges of areas where they possess sufficient experience.
For abilities, Hoge and Coladarci (1989) reported a median correlation of .66 between teacher judgment and student test performance in a meta-analysis. Independent of the subject matter tested, teachers were able to make qualified judgments of students' performances. A new meta-analysis including 77 studies (Südkamp, Kaiser, & Möller, submitted) corroborates these findings by reporting an overall mean effect size of .61 for the relationship between teacher judgment and academic achievement and no differences between the quality of judgments in language arts and mathematics. In other areas, the predictive validity of teachers' judgments is considerably lower.

For creativity, Sommer et al. (2008) mentioned in a study of fourth grade elementary students a correlation coefficient of .34 between teacher judgment and student creativity. In another investigation with elementary school children an effectivity score of 22% and an efficiency value of 19% was found (Heller, Reimann, & Senfter, 2005). This means that the teachers failed to detect the majority of creative students and, at the same time, labeled many students incorrectly as highly creative. Nicholson and Moran (1986) reported that teachers' ratings of creativity were more correlated with the measure of intelligence (r = .46) than with scores on children's originality (r = .10). Holland (1959) explains teachers' misjudgments of students' creativity by a "halo effect": teachers rate students' traits according to overall evaluations instead of looking at individual characteristics. Furthermore, teachers prefer to have intelligent rather than creative students in their class even if both student groups are equally superior to other students in school achievement (Getzels & Jackson, 1958).

For learning motivation, Spinath (2005) reported a correlation of .20 between class teachers' judgments and elementary students' self-assessments. An even smaller correlation of .10 for learning motivation was found in a study conducted at Austrian elementary schools (Urhahne, Chao, Florineth, Luttenberger, & Paechter, 2011). Also related constructs of learning motivation like students' subject interests do not seem to be accurately predicted by teachers' judgments. In a study of Karing (2009), elementary school teachers could assess students' interest in mathematics (r = .37) and their interest in German (r = .30) in a similar but not very valid fashion. It can be assumed that the halo effect found for misjudging students' creativity (Holland, 1959) can be equally responsible for the low agreement between teachers' and students' learning motivation data.

Research Questions

On the basis of the three-ring model of giftedness by Renzulli (1978; 2005), a research study was conducted aiming to answer the following research questions:

1. How accurate are teachers' judgments of students' abilities, creativity, and task commitment?
2. Are teachers' judgments of students' creativity influenced by students' abilities (halo effect)?
3. Can teachers identify the most able, creative, and task committed students?

Method

Participants

Eight classes from four different Munich elementary schools and their corresponding class teachers took part in the investigation. The 144 fourth graders, 78 boys and 64 girls (2 missing data for gender), were between 8 and 12 years old (M = 9.93, SD = .61). The female class teachers were on average 42.13 years old (SD = 10.99) and had a teaching experience of M = 14.38 years (SD = 9.43). On average, the teachers instructed the children for 19.63 hours per week (SD = 3.11), mainly in German and mathematics.
**Instruments**

**Ability.** To measure students' mathematical abilities, the German Mathematics Test for Fourth Grade (DEMAT 4; Gölitz, Roick, & Hasselhorn, 2006) was used. The standardized mathematics test comprises forty test tasks from the areas arithmetic, algebra, and geometry. The test is available in two parallel forms, which were both used in this study in order to prevent students from cheating. The test authors report an internal consistency of the DEMAT 4 at the end of the fourth grade of Cronbach’s $\alpha = .85$. The construct validity of the test is given by a correlation of .70 with the mathematics grades at the end of the fourth grade (Gölitz et al., 2006). To facilitate teachers’ assessment of students’ abilities, some test tasks were combined into a single task. One such example is a bus schedule where four departure times have to be filled in. This task was only counted as solved when all departure times were stated correctly. Thereby, the total number of tasks of the DEMAT 4 was reduced from 40 to 36.

**Creativity.** Two subtests of the Creativity Test for Preschool and School Children (KVS-P; Krampen, 1996) were selected to measure fourth graders’ creativity. The subtest Picture Guessing (Bilderraten) primarily stimulates test takers visually by presenting an incomplete drawing and provokes students’ verbal idea production. The subtest Bounded Drawings (Gebundene Zeichnungen) also primarily stimulates individuals visually by showing twelve ovals but provokes the production of figural ideas. Both subtests were evaluated with respect to two creativity criteria: idea fluency and idea flexibility. Idea fluency is a quantitative indicator of creativity. It is evaluated by giving one point for every produced and non-overlapping student solution. Idea flexibility is regarded as a qualitative indicator of creativity. It is measured by a differentiated category system where produced solutions are classified into 18 distinct categories such as fruits and vegetables; fantasy figures, monsters and fairies; or vehicles and means of transportation. The two evaluation criteria of the two subtests were combined into a short creativity scale with four items only. The diversified creativity scale had a sufficient reliability of Cronbach’s $\alpha = .70$.

**Task commitment.** Recognizing the multifaceted structure of task commitment, two indicators, learning effort and mastery goal orientation, were selected to measure the motivational construct of Renzulli’s three-ring model. Four items on learning effort, mirroring the perseverance and hard work aspects of task commitment, were taken from the national documentation of measuring instruments of PISA 2003 (PISA-Konsortium Deutschland, 2006). A sample item on learning effort was ‘I don’t give up even if the mathematics homework is very difficult and extensive’. Five items on mastery goal orientation, reflecting the epistemic interest and intrinsic value aspects of task commitment, were chosen from the Ulm Motivational Test Battery (Ziegler, Dresel, Schober, & Stöger, 2005). A sample item on mastery goal orientation was ‘I want to extend my mathematics skills’. The combined scale on task commitment, with a total of 9 items, showed a satisfying reliability of Cronbach’s $\alpha = .76$.

**Teacher data.** The teachers received copies of the DEMAT 4 and the KVS-P subtests and were requested to answer following items for every student in their class:

- Student ability (How many of the 36 tasks does the student solve correctly?)
- Creativity (How high is the student’s creativity in comparison to students of the same age? 1-very low to 9-very high)
- Learning motivation (How high is the student’s learning motivation in comparison to students of the same age? 1-very low to 9-very high)
- Learning effort (How high is the student’s learning effort in comparison to students of the same age? 1-very low to 9-very high)

Teachers’ judgments of learning motivation and learning effort were subsequently combined into one judgment of task commitment.
Procedure

The whole investigation in the elementary schools lasted for two lessons. In the first lesson, students worked on the DEMAT 4. In the second lesson, students received the two subtests of the KVS-P and filled in a self-descriptive questionnaire including the task commitment items. Students were given sufficient time to use their imagination on the creativity test and to respond to all items of the questionnaire. At the same time, teachers answered how they estimated each student’s their mathematical ability, creativity, learning motivation and learning effort for all students in their class.

Results

The means, standard deviations, minimum, maximum and median of student characteristics and teacher judgments are presented in Table 1. On the basis of the median, a split into two different groups, above-average and below-average students, will be made for further analyses as suggested by the Renzulli model.

Pearson correlations between teachers’ judgments and students’ characteristics are shown in Table 2. It can be seen that the three interlocking traits, which span the Renzulli model, are nearly independent of each other. There is only a small correlation between students’ mathematical abilities and creativity, while task commitment is unrelated to the other two giftedness components. Furthermore, the accuracy of teachers’ judgments about students’ abilities, creativity, and task commitment can be taken from Table 2. The results are directly in line with prior research in the corresponding fields. Teachers’ ability judgments strongly correlate with students’ mathematical abilities ($r = .69$). The correlation between teachers’ creativity judgments and student creativity is significant but small ($r = .23$). Students’ task commitment, however, could not be reliably predicted by teachers’ judgments ($r = .12$). It can also be derived from Table 2 that teachers’ judgments are subject to a halo effect. Teachers’ judgments of students’ creativity ($r = .54$) and task commitment ($r = .62$) are both highly correlated with student ability. Teachers’ judgments are also correlated with age by favoring younger students but not with gender. This is not completely correct: female elementary students were slightly better in the creativity test than their male counterparts (see Table 2).

Table 1. Descriptive Statistics of Student Characteristics and Teacher Judgments

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Mdn</th>
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<tbody>
<tr>
<td>Ability</td>
<td>21.00</td>
<td>5.78</td>
<td>8</td>
<td>33</td>
<td>21.00</td>
</tr>
<tr>
<td>Creativity</td>
<td>27.87</td>
<td>8.52</td>
<td>12</td>
<td>52</td>
<td>27.00</td>
</tr>
<tr>
<td>Task commitment</td>
<td>32.40</td>
<td>3.45</td>
<td>19</td>
<td>36</td>
<td>33.00</td>
</tr>
<tr>
<td>Ability judgment</td>
<td>24.07</td>
<td>5.46</td>
<td>5</td>
<td>36</td>
<td>25.50</td>
</tr>
<tr>
<td>Creativity judgment</td>
<td>5.51</td>
<td>1.81</td>
<td>1</td>
<td>9</td>
<td>5.00</td>
</tr>
<tr>
<td>Commitment judgment</td>
<td>10.83</td>
<td>4.12</td>
<td>2</td>
<td>18</td>
<td>11.00</td>
</tr>
</tbody>
</table>

Table 2. Intercorrelations Among Student Characteristics, Teacher Judgments, and Socio-Demographic Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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</thead>
<tbody>
<tr>
<td>1. Ability</td>
<td>—</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Creativity</td>
<td>.25**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3. Task commitment</td>
<td>-.07</td>
<td>.09</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Ability judgment</td>
<td>.69***</td>
<td>.26**</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Creativity judgment</td>
<td>.54***</td>
<td>.23**</td>
<td>-.01</td>
<td>.54***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Commitment judgment</td>
<td>.62***</td>
<td>.24**</td>
<td>.12</td>
<td>.67***</td>
<td>.66***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Age</td>
<td>-.25**</td>
<td>-.06</td>
<td>.17*</td>
<td>-.26**</td>
<td>-.33***</td>
<td>-.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Gender</td>
<td>.00</td>
<td>.24**</td>
<td>-.07</td>
<td>-.04</td>
<td>.05</td>
<td>.15</td>
<td>-.06</td>
<td></td>
</tr>
</tbody>
</table>

Note. * p < .05, ** p < .01, *** p < .001; gender-coded: 1 - male, 2 - female.
Using a linear regression analysis, it was tested whether teachers’ judgments of students’ creativity is influenced by other student characteristics. Besides student creativity, ability, age and gender were included in the regression model. Table 3 shows that student ability is a strong predictor of teachers’ creativity judgments. Student creativity, however, cannot significantly predict teachers’ creativity judgments. In addition, teachers tend to judge younger students as more creative.

Another linear regression analysis shows the real dependencies between student variables. In Table 4, student creativity is regressed on student ability, age, and gender. Indeed, creativity depends on ability but the relationship is not as strong as the teachers assumed. Whereas teachers think that younger students are more creative, a relationship between student age and creativity cannot be found. Moreover, gender appears to be a significant predictor of student creativity (see Table 4). However, teachers have not foreseen that girls were more creative in the applied test than boys.

In a final step, the accuracy of teacher judgment for selecting gifted students on the basis of the Renzulli model was tested. Therefore, it was assumed that students should show above-average scores on the dimensions ability, creativity and task commitment. Teacher judgments and student characteristics were dichotomized with a median split for all three dimensions. The results can be seen in Table 5. Teachers could correctly detect 10 out of the 20 students who showed above-average scores on all dimensions. The effectiveness of teachers’ judgments, calculated by the number of correctly identified divided by the total number of confirmed gifted, amounts to fifty percent. However, teachers mistakenly judged 29 additional students as having above-average characteristics on the three giftedness dimensions. The efficiency of teachers’ judgments, given by the number of correctly identified divided by the total number of nominated, is 25.6 per cent.

Table 3. Linear Regression Analysis to Predict Teachers’ Creativity Judgment by Students’ Creativity, Ability, Age, and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creativity</td>
<td>.02</td>
<td>.02</td>
<td>.09</td>
<td>ns</td>
</tr>
<tr>
<td>Ability</td>
<td>.14</td>
<td>.02</td>
<td>.47</td>
<td>.001</td>
</tr>
<tr>
<td>Age</td>
<td>-.58</td>
<td>.21</td>
<td>-.20</td>
<td>.01</td>
</tr>
<tr>
<td>Gender</td>
<td>-.01</td>
<td>.26</td>
<td>-.01</td>
<td>ns</td>
</tr>
</tbody>
</table>

Note. $R^2 = .335; F(4, 138) = 16.86, p < .001$.

Table 4. Linear Regression Analysis to Predict Students’ Creativity by Ability, Age, and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p &lt;</th>
</tr>
</thead>
<tbody>
<tr>
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<td>.24</td>
<td>.01</td>
</tr>
<tr>
<td>Age</td>
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<td>1.16</td>
<td>.02</td>
<td>ns</td>
</tr>
<tr>
<td>Gender</td>
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<td>1.38</td>
<td>.24</td>
<td>.01</td>
</tr>
</tbody>
</table>

Note. $R^2 = .112; F(3, 135) = 5.70, p < .001$.

Table 5. Teachers’ Effectiveness and Efficiency in Identifying the Most Able, Creative, and Task Committed Students

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correctly labeled</th>
<th>Incorrectly labeled</th>
<th>Effectiveness</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>gifted</td>
<td>non-gifted</td>
<td>gifted</td>
<td>non-gifted</td>
</tr>
<tr>
<td>Ability</td>
<td>53</td>
<td>57</td>
<td>19</td>
<td>15</td>
</tr>
<tr>
<td>Creativity</td>
<td>36.8%</td>
<td>39.6%</td>
<td>13.2%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Task</td>
<td>27.7%</td>
<td>32.6%</td>
<td>19.9%</td>
<td>19.9%</td>
</tr>
<tr>
<td>commitment</td>
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<td>44</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Three-ring</td>
<td>10</td>
<td>91</td>
<td>29</td>
<td>10</td>
</tr>
<tr>
<td>competencies</td>
<td>7.1%</td>
<td>65.0%</td>
<td>20.7%</td>
<td>7.1%</td>
</tr>
</tbody>
</table>
Discussion

This study investigated the accuracy of teacher judgment with regard to the popular three-ring giftedness model by Renzulli (1978; 2003) in a sample of elementary school children. Teachers were found to be experts for judging student performance as a high correlation between teacher judgment and student performance in the applied mathematics test was found. Beyond this area, however, teachers’ judgments were found to be vulnerable to inaccuracy in judging student characteristics. Teachers could quite accurately predict students’ mathematical achievements but failed to correctly assess their creativity and task commitment. Teachers’ creativity judgments were heavily influenced by a halo effect in that students’ ability but not students’ creativity turned out to be the main point of reference for teachers. As the three clusters of traits of the Renzulli model are nearly empirically unrelated to each other, the halo effect caused a strong misjudgment of students’ creativity and task commitment. Thereby, teachers were not very effective in diagnosing students of above-average abilities. In fact, half of them were overlooked. Moreover, teachers were also not very efficient as they nominated many more students to be gifted than actually were in the sample. In conclusion, if an extended definition of giftedness like the one from Renzulli is taken as a basis, it is hardly possible for teachers to assist in the process of selecting the most qualified students.

Renzulli (1993; 2005) seems to know about the weaknesses of his model in the identification of gifted and talented students as he suggested a different selection strategy, which cannot be directly derived from the three-ring conception of giftedness. Renzulli (2005) suggests building a total talent pool, which consists of approximately 15% of a school population. Approximately half of the talent pool should be identified by achievement test scores. Those students ranking at 92nd percentile and higher in the test will be automatically included in the talent pool. In step 2, trained teachers should be allowed to nominate students of above-average creativity, engagement, uncommon interests, and talent in special areas (Renzulli, 1993). In step 3, alternative pathways like self-nominations, nominations by parents, peers, or a selection committee, previous products assessment or creativity tests are suggested. In step 4, previous-year teachers can recommend seemingly overlooked students. In steps 2 to 4, the other half of the talent pool will be generated. The nomination process for gifted students suggested by Renzulli (1993; 2005) seems to be fair as all parties involved are given the right to make recommendations. However, taken the fallibility of teachers’ judgment into account, there are some doubts that Renzulli’s identification system leads to better outcomes than a completely test-based identification procedure.

Checklists measure students’ talents by multiple indicators that describe children’s characteristics or behaviors. These checklists are very popular to identify students of high ability (Perleth, 2010) or high creativity (Runco, 1989, 2010). As in this study teachers’ judgments of students’ abilities and creativity were only measured by one item each, it might be argued that the use of checklists for giftedness and creativity would enhance the validity of teachers’ judgments. Research results by Sommer et al. (2008), however, point out that intelligence and creativity checklists are not better suited to predict students’ test scores than global estimations of the respective dimension. In addition, Perleth (2010) states that the classification efficiency of parent checklists in order to separate gifted from non-gifted students can be seen as low. Thus, the use of a more sophisticated measuring instrument helping to assist teachers in the process of estimating students’ abilities, creativity, and task commitment would not automatically have led to better judgment scores.

Another critique that might be uttered against the presented research findings is that teachers were not asked to assess students’ intelligence but only their mathematical abilities. Would the elementary school teachers have been more accurate if they were allowed to assess students’ intelligence? Although this is possible, known research results point in the other direction. The meta-analytic relationship between teacher judgment and
student performance on a standardized achievement test amounts to \( r = .61 \) (Südkamp et al., submitted). Research investigating the relationship between teacher judgment and student intelligence never exceeded this correlation value (Heller, Reimann et al., 2005, Sommer et al., 2008, & Spinath, 2005). Thus, the assessment of mathematical abilities instead of intelligence facilitated teachers' judgment processes. By including intelligence estimates, it is not very likely that teachers would have become better judges of students' talents according to the three-ring conception of giftedness.

All in all, this study illuminates the difficulties of identifying the most gifted and talented students in elementary school classes. Even if the class teachers have considerable experience with the assessed children and knew them all well, test results reveal that real expertise of teacher judgment can only be assured for the area of test performance. Students' creativity and task commitment, which are equally important in developing a creative-productive personality in the future, should better be assessed by alternative means.

References


Renzulli, J. S. (2005). The three-ring conception of giftedness: A developmental model for...


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**The Author**

Prof. Dr. Detlef Urhahne studied business administration and psychology at the University of Bielefeld. He received his PhD at the University of Kiel in 2001 and finished his habilitation at the Ludwig-Maximilians-University Munich in 2008. Currently, Detlef Urhahne is working as a professor of educational psychology at the Martin-Luther-University Halle-Wittenberg. His main research interests are in the areas of learning motivation, teacher judgment and computer-based learning environments.
Influence of the Selection Level, Age and Playing Position on Relative Age Effects in Swiss Women’s Soccer

Michael Romann1* and Jörg Fuchslocher1

Abstract: Relative age effects (RAEs) refer to age differences in the same selection year. In this study, 6,229 female soccer players representing the entire Swiss female soccer population were evaluated to determine the prevalence of RAEs in Swiss women’s soccer. Significant RAEs existed in the self-selected extracurricular (n = 2987) soccer teams and the subgroup of talent development teams (n = 450) in the 10 to 14 age category. No significant RAEs were found for players 15 years of age or older (n = 3242) and the subgroup of all national teams (n = 239). Additionally, significantly stronger RAEs were observed in defenders and goalkeepers compared to midfielders in national teams. Our findings show that in Switzerland, RAEs apparently influence the self selection and talent selection processes of women’s soccer in the 10 to 14 age category. However, in contrast to male soccer we found no RAEs in elite women’s soccer teams.

Keywords: talent development, selection, female soccer, birth date

Children are grouped by age for sport activities to reduce the effects of developmental discrepancies. However, this procedure leads to age differences between individuals in the same annual cohort. This can lead to an age difference of almost 12 months between the youngest and the oldest participants, known as relative age effects (RAEs). RAEs were initially observed in school settings, describing the link between the month of birth and academic success (Bigelow, 1934; Dickinson & Larson, 1963). In sports, RAEs have gained increasing awareness among sports scientists and coaches over the last three decades. Early research from 1984 until today has identified a consistent prevalence of RAEs within a variety of sports at the junior level (Cobley, Baker, Wattie, & McKenna, 2009). Soccer is among a group of highly popular sports, such as ice hockey, with the highest prevalence of RAEs (Cobley et al., 2009). In some exceptional activities like golf (Côté, Macdonald, Baker, & Abernethy, 2006), where physical attributes are less important, RAEs have not been identified. In dance and gymnastics, no or even inverse RAEs have been shown to exist (Baxter-Jones & Helms, 1996; Malina, Bouchard, & Bar-Or, 2004; van Rossum, 2006).

In male soccer, different mechanisms have been proposed for explaining the causes of RAEs. Maturational differences and physical attributes (e.g., greater aerobic power, muscular strength, and height) appear to be mainly responsible (Carling, le Gall, Reilly, & Williams, 2009). As RAEs are based on chronological age, relatively older children consistently have an advantage, favouring an advanced maturation (Schorer, Cobley, Busch, Brautigam, & Baker, 2009). It is also important to note that an even higher impact results from biological age differences, which refer to psycho-physical maturity and can lead to variations of more than two years (Malina & Bielicki, 1992). Additional explanations for relatively older children’s superior performance involve psychological development,

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practice experience, and mechanisms related to the selection processes (Musch & Grondin, 2001). Once selected, the relatively older children also experience better coaching, more positive feedback, deeper involvement, and more intense competition, all of which enhance performance (Sherar, Baxter-Jones, Faulkner, & Russell, 2007). On the other hand, children with a relative age disadvantage play at a competitively lower level and have less support and training. As a consequence, those children are less likely to reach the highest levels in elite sports (Helsen, Starkes, & Van Winckel, 2000) and are more likely to drop out of a particular sport (Delorme, Boiché, & Raspaud, 2010a). Musch and Grondin (2001) described factors related to the sport setting that may increase RAEs in male sports, such as the sport's popularity, the level of competition, early specialization, and the expectations of coaches who are involved in the selection process. Generally, soccer's importance and popularity has increased during the last decade, resulting in a higher number of players who wish to play soccer (Cobley, Schorer, & Baker, 2008; Wattie, Baker, Cobley, & Montelpare, 2007). The increasing participation and infrastructure intensifies the competition to be selected for elite teams. Additionally, there has been an increasing emphasis of clubs to detect young players who are likely to become world-class performers (Wattie, Cobley, & Baker, 2008). Finally, in international junior soccer, there may be a focus on winning instead of developing talent for the elite stage (Helsen, Hodges, Van Winckel, & Starkes, 2000).

Most studies concerning RAEs in soccer, however, have been focused on male athletes and researchers still need to understand the mechanisms that affect RAEs, as well as confirm whether RAEs exist in female contexts (Cobley et al., 2009).

As part of the Training of Young Athletes (TOYA) longitudinal study, Baxter-Jones and Helms (1994) carried out a study examining RAEs in elite female athletes. The researchers showed that almost 50% of elite female swimmers and 8 to 16-year-old tennis players were born in the first quarter of the selection year. In the same way, Delorme and Raspaud (2009) observed a significant relative age effect in all female and male youth categories in French basketball.

Although there has been an exponential growth in the number of women playing soccer worldwide (Williams, 2007), Musch and Grondin (2001) observed that the effect of an athlete's gender on RAEs still remains neglected. To our knowledge, only three studies to date have investigated RAEs in women's soccer. On one hand, RAEs were observed among all registered female players in the French federation (Delorme, Boiché, & Raspaud, 2010b), but no RAEs were found among high-level female soccer players (Delorme, Boiché, & Raspaud, 2009). On the other hand, Vincent and Glamser (2006) compared the relative age effect among 1,344 male and female soccer players of the U.S. Olympic Development Program. In their study, marginal RAEs were shown for girls at the national and regional levels and no RAEs for those playing at the state level. However, the results revealed large RAEs for boys at all levels. Hence it can be stated, that the available data concerning RAEs in female soccer is sparse and reveals contradictory results.

In Switzerland, women's soccer is rapidly gaining popularity, which may be due to the success of the men's soccer team (Swiss Federal Office of Sport, 2010). Despite the country's small population (7.7 million), the Swiss male senior team was listed 13th in January 2010 in the FIFA world ranking, and the male Swiss U-17 team won the European Cup in 2002 and the World Cup in 2009. Due to these achievements, Tschopp, Biedert, Seiler, Hasler, and Marti (2003) assumed that the Swiss soccer federation may have a relatively efficient and successful talent development system. However, RAEs have still not been investigated in Swiss women's soccer.

In previous literature, links between male RAEs, maturation, and playing positions have been identified, which could have biased the talent identification process. More mature players with more experience in soccer perform better in ball control by using their body size. In addition, a player's level of maturity significantly contributes to variations in shooting accuracy (Malina et al., 2005). In boys' soccer, forwards were found to be significantly leaner than midfielders, defenders, and goalkeepers. A discriminating
variable of male defenders compared to midfielders and strikers is their lower leg power (Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007). Interestingly, in contrast to the selection bias of RAEs, senior male players born late after the cut-off date have been shown to earn systematically higher wages (Ashworth & Heyndels, 2007). This effect was reported as being strongest for goalkeepers and defenders, but not evident for forwards. It was speculated that this pattern could reflect a bias in talent scouts’ selection of teams and playing positions. This finding is consistent with Grondin and Trudeau (1991), who demonstrated a link between male ice hockey players’ RAEs and playing positions. In their analysis, the RAEs were strongest among defenders and goalkeepers. Moreover, physical attributes and playing positions are related to the magnitude of RAEs in both men’s handball (Schorer, Cobley, Busch, Brautigam, & Baker, 2009) and men’s rugby (Till et al., 2009). Whether there is a link between RAEs and playing positions in women’s soccer has not been analyzed to date.

Given the relevance of RAEs and their potential for introducing a bias in talent identification, it is worth examining RAEs in the overall setting of Swiss women’s soccer. Therefore, the purposes of this study were twofold: first, to examine the prevalence and size of RAEs at the different age and performance levels of Swiss women’s soccer, and second, to identify if playing positions modify the prevalence and size of RAEs.

Methods

Participants

The Swiss system of talent identification, selection, and development is based on three levels of performance (Figure 1). The first level is a nationwide extracurricular program called Jugend und Sport (J+S), which is offered for all children interested in a specific sport. Soccer is one of 77 disciplines available. The minimum duration for a J+S course is at least 30 weeks per year with one training session per week. Every soccer training session has to last at least 60 minutes. J+S contains \( n = 6,157 \) registered female soccer players ranging from 10 to 20 years of age, which is 1.4% of the female Swiss population \( (N = 440,934) \). The female Swiss population was defined as the number of live female births in Switzerland in the respective age groups. The second level is the national talent detection and development program of J+S. These players \( (n = 1,067) \) are assisted by licensed soccer trainers and are expected to train more than 400 hours per year (Swiss Federal Office of Sport, 2010). The Swiss Soccer Association and the Swiss Olympic Association jointly established the cut-off criterion for adoption into the program as 400 hours. All data for the Swiss population, J+S and the talent development program of J+S involve the 2009–2010 season. The national teams \( (n = 167) \) represent the third level. The inclusion criterion for a national team player was the selection to a Swiss national under-17 (U-17), under-19 (U-19), or the senior team (A team) in the 2007–2008, 2008–2009, and 2009–2010 seasons.

<table>
<thead>
<tr>
<th>Swiss population aged 10 to 20 ((N=440934))</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;J+S&quot; (level 1) aged 10 to 20 ((n=6157))</td>
</tr>
<tr>
<td>Talent development (level 2) aged 10 to 20 ((n=1067))</td>
</tr>
<tr>
<td>National teams (level 3) aged 16 to 33 ((n=239))</td>
</tr>
</tbody>
</table>

Figure 1. Overview of the different levels of selection in Swiss women’s soccer.
In total, we examined the birth-date distributions of three Swiss national teams for each of three seasons (nine in total) in order to calculate the relationship between RAEs and playing positions. Comparisons were carried out between the datasets of the junior national teams, players in the talent detection (TD) program, all registered J+S players, and the entire Swiss population.

**Procedure**

All 6,229 female soccer players were grouped according to the month of the selection period. The birth month of each player was recorded to define the birth quarter (Q). The cut-off date for all soccer leagues in Switzerland is January 1st. The year was divided into four quarters (Q1 represents January, February, and March; Q2 represents April, May, and June; Q3 represents July, August, September; and Q4 represents October, November, and December). The observed birth-date distributions of all players were calculated for each quarter. The expected birth-date distributions were recorded from the J+S database, where all players who participate in organized soccer activities are registered. Beforehand, the Swiss Youth Sport database was analysed in order to verify that there are no statistical differences between the birthdates of all registered J+S player's (aged 10–20 years) and all corresponding birth dates of the Swiss female population (aged 10–20 years). According to Delorme et al., (2010a) we used the distribution of J+S (all registered players) as a basis (expected distributions) to evaluate RAEs instead of the female Swiss population. If a biased distribution already existed among the entire population of registered players (J+S; level 1), the same pattern would arise among the elite (level 3) as well, and bias the conclusions drawn about RAEs among the elite.

From these original data, odds ratios (ORs) were calculated for Q1 versus Q4. All statistical analyses were carried out using SPSS 16.0. Chi-square tests were used to assess differences between the observed and expected birth date distributions. If the differences were significant then post hoc tests were used to determine the mean differences between the quarters. In addition, effect sizes were computed to qualify the results of the chi-square tests. The appropriate index of effect size is the phi coefficient ($\phi$) if there is one degree of freedom ($df$), and Cramer’s V ($V$) is appropriate if the $df$ is above 1 (Aron, Aron, & Coups, 2002).

For the chi-square analyses, the magnitude of the effect size was measured using $\phi$ and $V$. According to Cohen (1977) and Cramer (1999), for $df = 3$ (which is the case for all comparisons of birth quarters), $V = 0.06$ to 0.17 described a small effect, $V = 0.18$ to 0.29 described a medium effect, and $V \geq 0.30$ described a large effect. An alpha level of $p < 0.05$ was applied as the criterion for statistical significance.

**Results**

**Prevalence of RAEs in Swiss Women’s Soccer**

Significant RAEs were found already in the subgroup of all registered J+S players who were 10 to 14 years old (Table 1). The distribution showed a small but significant overrepresentation of Q1 elite players and a significant underrepresentation of Q4 elite players compared to the respective Swiss population. However, no significant RAEs were found for the 15- to 20-year-old age group of J+S players.

The analyses of talent development teams revealed similar findings as for the J+S players. There were significant RAEs in the 10- to 14-year-old age group and no RAEs in the 15- to 20-year-old age group. For all players in the 10- to 14-year-old age group, the chi-square and post hoc tests highlighted an overrepresentation of players born at the beginning of the selection year and a decreasing number of players born at the end of the year. For all national elite teams, no significant RAEs were identified.
The peak of the RAEs was found in the U-10 and the U-11 talent development teams, where 66.6% of the players were born in the first half of the year (Figure 2). This ratio is lower in the higher age categories, ranging from 59% to 49% in the U-12 to U-18 talent development teams.

Table 1. Birth-Date Distribution of the Swiss Female Soccer Population

<table>
<thead>
<tr>
<th>Category</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Total</th>
<th>χ²</th>
<th>p</th>
<th>OR</th>
<th>V</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP (10-20)</td>
<td>109682</td>
<td>111428</td>
<td>113838</td>
<td>105966</td>
<td>440934</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(%)</td>
<td>24.8%</td>
<td>25.3%</td>
<td>25.9%</td>
<td>24.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J+S (10-14)</td>
<td>794</td>
<td>811</td>
<td>728</td>
<td>654</td>
<td>2987</td>
<td>16.08</td>
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</tr>
<tr>
<td>(%)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>856</td>
<td>831</td>
<td>774</td>
<td>3242</td>
<td>6.1</td>
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</tr>
<tr>
<td>(%)</td>
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<td>25.6%</td>
<td>23.9%</td>
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<td></td>
<td></td>
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<tr>
<td>TD (10-14)</td>
<td>135</td>
<td>123</td>
<td>119</td>
<td>73</td>
<td>450</td>
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<td>&lt;0.001</td>
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<td>0.11</td>
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</tr>
<tr>
<td>(%)</td>
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<td>27.3%</td>
<td>26.4%</td>
<td>16.2%</td>
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<tr>
<td>TD (15-20)</td>
<td>167</td>
<td>161</td>
<td>152</td>
<td>137</td>
<td>617</td>
<td>2.47</td>
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<td>1.22</td>
<td>0.04</td>
<td>no</td>
</tr>
<tr>
<td>(%)</td>
<td>27.1%</td>
<td>26.2%</td>
<td>24.4%</td>
<td>23.3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-17</td>
<td>20</td>
<td>29</td>
<td>23</td>
<td>15</td>
<td>87</td>
<td>4.7</td>
<td>&gt;0.05</td>
<td>1.33</td>
<td>0.13</td>
<td>small</td>
</tr>
<tr>
<td>(%)</td>
<td>23.0%</td>
<td>33.3%</td>
<td>26.4%</td>
<td>17.2%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U-19</td>
<td>24</td>
<td>20</td>
<td>22</td>
<td>14</td>
<td>80</td>
<td>2.8</td>
<td>&gt;0.05</td>
<td>1.71</td>
<td>0.11</td>
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</tr>
<tr>
<td>(%)</td>
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<td>25.0%</td>
<td>27.5%</td>
<td>17.5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A-Team</td>
<td>23</td>
<td>17</td>
<td>21</td>
<td>11</td>
<td>72</td>
<td>4.7</td>
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<td>2.09</td>
<td>0.15</td>
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<tr>
<td>(%)</td>
<td>31.9%</td>
<td>23.6%</td>
<td>29.2%</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note. SP = Swiss population; J+S = Players of extracurricular soccer teams; TD = Players of talent development teams; OR = Odds ratio; V = Cramer’s V.

Figure 2. Distribution of births in the first half year of talent development teams (level 2) compared to the Swiss population and all registered J+S players (level 1).
Playing Positions

The birth date distributions for playing positions in the national elite U-17 to A-teams are presented in Figure 3. Chi-square tests showed significant differences for defenders and strikers compared to the J+S distribution ($p < 0.05$). Defenders were overrepresented in Q1 (36.6%) and Q3 (31.0%), and underrepresented in Q4 (8.5%). Strikers were overrepresented in Q2 (41.2%) and Q3 (31.4%), and underrepresented in Q4 (5.9%).

In a second analysis, we calculated the distribution of birth dates between the different playing positions. Defenders and goalkeepers were significantly ($p < 0.05$) overrepresented in the beginning of the year compared to midfielders. The remaining comparisons were not significant.

Discussion

Prevalence of RAEs in Swiss Women’s Soccer

Interestingly, the self-selected J+S players (Level 1, 10 to 14 years), which represent the respective regularly playing soccer population, already showed RAEs and differed significantly from the Swiss population's distribution. We found small but consistent RAEs in the 10- to 14-year-old age group of talent development players (Level 2). However no significant RAEs were found in the 15- to 20-year-old age groups at all levels (J+S, talent development and national level). Moreover, we demonstrated that playing positions are interrelated with the prevalence and size of RAEs in female soccer. In the present study, the defenders and goalkeepers showed significantly higher RAEs compared to midfielders.

In line with previous studies, no RAEs were detected in the highest selection levels of all female junior age categories (15- to 20-year-olds; Delorme et al., 2010b; Vincent & Glamser, 2006). A possible explanation might be that female anaerobic and aerobic characteristics, running speed and physical fitness performance reach a plateau shortly after menarche (Haywood & Getchell, 2001; Thomas, Nelson, & Church, 1991). Similar developments of gross motor skill performance, agility, jumping and kicking tests have
been found for girls (Gabbard, 2000; Thomas & French, 1985). Therefore, some of the physiological benefits of being born early in the selection year might disappear in the 15-to 20-year-old age group. In fact, after menarche adolescent girls’ athletic performance is poorly related to maturity status (Malina, 1994). Accordingly, late maturing girls frequently catch up with their peers who matured early and even produce superior athletic performances. In addition, late maturing girls generally have a more ecomorphic, linear physique with longer legs and relatively narrow hips, less body mass for their stature, and less adipose tissue (Malina, Eisenmann, Cumming, Ribeiro, & Aroso, 2004). In other words, early physical development is an advantage before and during puberty. However, early physical development acts as a socially constructed disadvantage for young women after puberty because a high relative age could facilitate their dropout from elite soccer (Delorme et al., 2010b). In addition, the physical characteristics needed for athletic performance are sometimes inconsistent with the stereotyped idea of an ideal female body (Choi, 2000). Traditionally, soccer as a contact sport has been considered gender-inappropriate for women. Researchers have argued that social pressures to conform to a socially constructed gender role, such as stereotyped ideas of femininity, could pressure early maturing girls to drop out of contact sports such as soccer, which may explain why the birth date distribution reveals no RAEs among elite players (Vincent & Glamser, 2006).

As pointed out, the self-selected J+S teams (level 1) in the 10 to 14 age group already showed small RAEs. In other words, girls born in the first half of the selection year are more likely to begin playing soccer compared with their younger counterparts. Those born in Q3 and Q4, probably because of their less advantageous physical and psychological attributes, show a kind of self-selection process before even trying to play soccer. One explanation could be that girls who mature early are generally taller and heavier, with more body mass for stature than late maturing girls (Baxter-Jones, Thompson, & Malina, 2002). This leads to athletic performance advantages early in puberty. It is important to note that, due to the possible self-selection (level 1), coaches of the talent development program (level 2) had to perform their selections using an unequally distributed pool of players, which could have increased RAEs in level 2.

In the present study, playing positions of all national players (level 3) were interrelated with the prevalence and size of RAEs in women's soccer. The defenders and goalkeepers showed significantly higher RAEs compared to midfielders. Recently, Schorer et al. (2009) showed that RAEs of male back court handball players on the left side are stronger than those on the right side. These results provide evidence that height, laterality and playing position affect the magnitude of RAEs in men's handball. This is in line with the observation that tall soccer players also tend to have an advantage, especially goalkeepers and central defenders (Di Salvo et al., 2007; Reilly, Bangsbo, & Franks, 2000). It can be speculated that Swiss coaches in women's soccer may also tend to select relatively older defenders and goalkeepers who are taller and more mature.

To optimize the talent development system in Switzerland further, the challenge seems twofold. On one hand, it seems important to include disadvantaged players due to RAEs in soccer activities at an early age. On the other hand, it is crucial to keep players involved in soccer after puberty ends.

**Possible Solutions**

Several solutions to reduce RAEs have been proposed in the literature. One solution is to establish “current” and “potential” teams: the “current” team contains the best players, both technically and physically, at the selection time, while the “potential” team contains players who are technically skilled, but who are lacking in terms of their physical development (Brewer et al., 1995). Barnsley and Thompson (1988) have suggested creating more age categories with a smaller bandwidth (e.g., six months rather than one year). This change would result in smaller RAEs and fewer physical differences between players within any specific age category. A single change in the selection date would
result in an equal shift of RAEs (Helsen et al., 2000). Therefore, Grondin et al. (1984) recommended an alteration of the activity year’s cut-off dates. A yearly rotation for the cut-off date might work, since all players would then experience the advantage of a higher relative age at some point in their soccer career (Hurley et al., 2001). One potential solution could be to change the mentality of youth team coaches (Helsen et al., 2000). Coaches should pay more attention to technical and tactical skills when selecting players, as opposed to over-relying on physical characteristics such as height and strength. Additionally, they should find a better balance between short-term success and a more process-oriented approach to instruction (Helsen et al., 2005).

The challenge for Switzerland will be to keep players who are physically or psychologically disadvantaged due to RAEs involved in the sport until they have fully matured. In the current Swiss system, players who are accepted on elite teams start benefiting quite early from receiving more support, a higher level of competition, increased training, longer playing times, more positive feedback and improved coaching. Alternatively, unselected players may tend to have lower self-esteem and show higher dropout rates (Helsen et al., 1998). Delorme et al. (2010a) illustrated that dropout rates result from two major processes. First, children born late in the selection year may be less likely to join a sport in which weight, height, or strength are seen as relevant for performance. It is important to note that the first phenomenon cannot be solved by federations reducing the RAEs. Second, those who are involved in a sport are more likely to drop out and have fewer chances to be selected.

The decrease in RAEs may substantially enhance performance at the elite senior level in the future, especially for Switzerland, which has a rather shallow talent pool due to the limited number of inhabitants. Interestingly, in the current Swiss coach education programme, only junior national level coaches are confronted with RAEs during their education. According to our data, the consequences of RAEs should be taught at all levels of coach education, particularly for coaches of talent development teams in the 10 to 14 age categories. Therefore, from our point of view, implementing rotating calendar cut-off dates and furthering the education of all soccer coaches may counteract future RAEs in Swiss soccer. Moreover, in Switzerland, talent identification and player development should be viewed as more long-term processes. In contrast to aspects of performance, assessments of skill and potential should be emphasised (Vaeyens, Lenoir, Williams, & Philippaerts, 2008). In any case, it would be a significant step forward for coaches and federations to select the teams with the highest potential in future elite soccer instead of the team with the highest chance of winning in the present (Helsen et al., 2000).

Main Findings and Conclusion

Based on the present data, we argue that small, but significant RAEs bias the participation and the selection process of women’s soccer in Switzerland up to the age of 14 years. However, our results indicate that RAEs do not influence the talent identification process of Swiss national elite teams. The RAEs seem to be largest already in the U-10 and U-11 squads, where three-quarters of the selected players were born in the first half of the year. Additionally, higher RAEs were observed in defenders and goalkeepers compared to midfielders. To minimize RAEs in Swiss women’s soccer, a systematic education for all soccer coaches regarding RAEs could be established.

References


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Development of Elite Adolescent Golfers
Ric
hard
 Hayman, Remco Polman, Jamie Taylor, Brian Hemmings and Erika Borkoles

Abstract: This study examined the nature of developmental, psychosocial and contextual factors experienced by elite adolescent golfers in an effort to establish which factors might be important to achieve elite status in golf. Participants were guided through a structured interview collecting quantitative data (after Cote, Ericsson & Law, 2005). Participants were eight Caucasian male adolescent amateur golfers with a handicap between +2 and +4. All were affiliated with international representative teams run by the English Golf Union. Participants did not follow an early specialisation trajectory and refrained from engagement within long term golf specific deliberate practice. Instead, participants encountered numerous sporting activities within a playful, developmentally supportive environment until selection for international representative teams during late adolescence, at which point deliberate practice became more evident. Such findings may provide practitioners within golf talent development systems with stronger scientific basis for their coaching and development interventions.

Keywords: deliberate practice, deliberate play, development, expertise, specialisation, diversified activity

There has been a growing interest in the contributions of innate abilities and environmental factors in the development of expertise across multiple disciplines including sport. In particular, recent research has tried to identify appropriate early developmental pathways for athletes as they progress from early sport engagement in childhood to expert performance in adulthood (e.g., Cote, Baker, & Abernethy, 2007, Cote, Lidor, & Hackfort, 2009; Ericsson, 2007; Ford, Ward, Hodges, & Williams, 2009). Considerable evidence across multiple disciplines including sport, academia and medicine emphasises the importance of domain specific deliberate practice in acquiring exceptional abilities (Ericsson, Charness, Feltovich, & Hoffman, 2006). Deliberate practice theory suggests that any healthy individual whose development includes a sufficient amount of deliberate practice (approximately 10,000 hours or ten years) can achieve expert status within any given field. Key in this theory is that training activities have to be designed to specifically improve an individual’s performance and that mere engagement in the activity is not sufficient (Ericsson, Krampe, & Tesch-Romers, 1993). Deliberate practice activities require sustained effort and attention, are not intended to be enjoyable, do not lead to immediate social or financial rewards and are performed solely for the purpose of performance enhancement rather than enjoyment (Starkes, 2000).

Research during the past 15 years has provided support for the critical role of deliberate practice as a form of training for developing exceptional levels of performance in cricket (Weissensteiner, Abernethy, Farrow, & Muller, 2008), road and track cycling (Schemacher, Mroz, Mueller, Schmid, & Ruecker, 2006), figure skating (Starkes, Deakin, Allard, Hodges, & Hayes, 1996), karate (Hodge & Deakin, 1998), wrestling (Hodges & Starkes, 1996),

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soccer (Helson, Hodges, Van Winckel, & Starkes, 2000, Ford et al., 2009), rhythmic dancing (Law, Cote, & Ericsson, 2007), swimming (Kjendlie, 2007) and field hockey (Helsen, Starkes, & Hodges, 1998; Ward, Hodges, Williams, & Starkes, 2007). Sport-specific deliberate practice activities and levels of performance were consistent with tenets of deliberate practice theory, indicating more hours of deliberate practice were undertaken by experts in comparison to non-experts.

While the association between deliberate practice (including early specialisation) and expertise development across numerous sporting disciplines exists (see Williams & Ford, 2008 for a review), there is opposing research which suggests that the decision to embark upon an early specialisation developmental pathway involves several trade-offs that may not provide an optimal environment for achieving lifelong involvement or elite status in sport (Cote et al., 2009). In particular, a number of negative consequences have been associated with early specialisation affecting physical, psychological and social development including dropout and burnout (Butcher, Linder, & Johns, 2002; Fraser-Thomas, Cote, & Deakin, 2008; Gould, Tuffey, Udry, & Loehr, 1996a, 1996b; Wall & Cote, 2007) increased injury rates (Baxter-Jones & Helms, 1996; Law, Cote, & Ericsson, 2007) and eating disorders (Anshel, 2004) in young athletes.

In contrast to deliberate practice theory, the Developmental Model of Sport Participation (DMSP; Cote & Hay, 2002) emphasises the importance of developmentally appropriate training patterns, activities and social influences in the prolonged engagement and attainment of increased sports participation and performance levels. The model claims athletes should pass through three stages of development: Sampling (aged 6–12), specialising (aged 13–15) and investment (aged 16 and above; Cote & Fraser-Thomas, 2007), and attaining sporting excellence may occur in fewer years than is predicted by deliberate practice theory. DMSP suggest that aspiring elite and recreational athletes should experience high quantities of deliberate play activities during the sampling years and refrain from undertaking deliberate practice until the specialising and investment years (Fraser-Thomas et al., 2008).

Evidence supporting the DMSP highlights the merits of late specialisation and engagement in a diversity of playful sporting activities as a superior means of nurturing athletic potential. For example, research examining early sport participation trends and developmental pathways experienced by elite international athletes in Australian rules football (Berry, Abernethy, & Cote, 2008), ice hockey (Soberlak & Cote, 2003), field hockey, basketball, and netball (Baker, Cote, & Abernethy, 2003), tennis (Carlson, 1988; Cote, 1999), triathlon (Baker, Cote, & Deakin, 2005) swimming (Barynina & Vaitsekhovskii, 1992; Johnson, Tenenbaum, Edmonds, & Costillo, 2008), and rowing (Cote, 1999) suggest early specialisation is not an essential component of elite athlete development. Findings from these studies suggest that following an introduction period consisting of unstructured and unsupervised playful enjoyable experiences, parents encouraged their children to attend training with a coach and engage in a selection of deliberate play and practice activities. This was followed by an increase in daily amounts of deliberate practice and exposure to superior training facilities as the children became older. Superior volumes of deliberate play and supportive social frameworks were frequently experienced by elite status sports performers prior to specialising in their predominant sport between ages 13–15.

It is widely accepted that considerable engagement within sport specific related activities will have a beneficial effect on subsequent performance but exactly how much and what type is not yet fully understood. Although contrasting rationales regarding the acquisition of exceptional performance levels within numerous sports exists, research examining the development of expert golf performance is sparse. The aim of the present study was to examine the developmental pathways of elite male adolescent golfers. In particular we examined which theoretical approach, deliberate practice or DMSP best described the pathway travelled by elite adolescent golfers.
Method

Participants

Participants were eight Caucasian male adolescent amateur golfers (age: $M = 18.8$, $SD = 2.1$) with a handicap between +2 and +4 (handicap: $M = +2.6$, $SD = 1.3$). All participants were affiliated with international representative teams run by the English Golf Union (EGU) and played golf competitions across a spectrum of levels (i.e. county, regional, national & international). Two players were under 18 internationals, four were England Senior A Team Development Squad members and two were current England Senior Men's A Team members. The competitive playing experience of the sample ranged between 6 and 12 years. The participants were assigned a number to protect their anonymity (1 to 8). The study had the approval of the University Ethics Committee and all participants provided informed consent prior to participation.

Procedure

Following approval by the EGU participants from various development squads were approached for participation in the study via email and telephone calls. Prior to being interviewed, participants were provided with verbal and written information on the procedure to be followed. As part of the process to develop a level of rapport prior to the interviews, participants were offered the choice of interview location in an effort to make them feel as comfortable as possible (Shuy, 2002), which in all cases was their home golf course.

Data collection and analysis

Participants were guided through a number of structured questions regarding their golfing history. Based on a retrospective interview procedure developed by Cote, Ericsson and Law (2005) quantitative data on the elite adolescent golfer's patterns of activity involvement and psychosocial influences throughout their development were collected. The interview schedule was guided by the theoretical framework of deliberate practice (Ericsson et al., 1993; Ericsson & Charness, 1995) and DMSP (Cote, 1999; Cote & Hay, 2002) and consisted primarily of closed questions. In particular, data were collected in five areas (a) Demographic information (i.e. place of birth); (b) Early activity involvement (i.e., time line of involvement in all leisure activities throughout development); (c) Developmental milestones (i.e., age golfers reached significant golf related milestones); (d) Golf specific activities (i.e., time spent undertaking specific types of golf training at each stage of golf development), and (e) Psychosocial influences (i.e., subjective ratings of parent, peer and coach influences during each stage of golf development). This procedure allows the examination of the changing environment of elite adolescent golfers throughout their development in golf. Participants were guided through the questions by the researcher and descriptive analysis of all data was conducted.

Results

Demographic Information

Based on parental professions and their post-code the golfers in the present study could be classified as coming from middle to upper socio economic backgrounds. Two of the participants attended private secondary schools and one participant was home schooled since the age of 13. The mean number of siblings was 1.13 who tended to be older than the participants (age: $M = 27.8$ years). Three siblings were ex-international sport
performers (one under 16 ice skater; two senior level international swimmers). One sibling is a current professional golfer playing on the Euro pro tour. All participants spent most of their life living in the same location they were born which had a mean population of 17,682 inhabitants (range 41,364–3,015).

**Early Activity Involvement**

Opposing deliberate practice theory, engagement within 10 years sustained golf practice was not a necessary requirement for acquiring adolescent golfing excellence. Participants did not undertake long term golf specific deliberate practice until they decided to specialise in golf once it became their sole purpose in life aged approximately 16. Instead, participants encountered a playful introduction to several team and individual sporting activities within a developmentally supportive environment until selection for international representative golf teams during mid to late adolescence. Year by year accounts of participant involvement within a range of sports revealed the mean number of sports undertaken during the sampling, specialising and investment years was 4.8, 4.5 and 1.8 respectively.

**Developmental Milestones**

Findings of pertinent golf related milestones were remarkably consistent across participants during childhood and early adolescence. Generally, participants did not experience early specialisation developmental pathways or display signs of exceptional golfing ability. During childhood and early adolescence, time spent undertaking deliberate practice golf activities was limited with participants preferring to experience a diverse selection of sports and physical activities in a fun environment. First participation in golf started aged approximately 9.5 years ($SD = 2.2$) with engagement in regular golf competitions starting at 11.1 years ($SD = 2.2$). The participants engaged in playful golf specific practice on their own or with a parent or coach from 12.8 years ($SD = 2.7$). This was followed quickly by a decision to become an elite golfer (age: $M = 13.0$ years; $SD = 3.4$) and the development of a close relationship with a golf coach (age: $M = 13.3$ years; $SD = 2.7$). From 14.9 years of age ($SD = 2.2$) participants spent most of their leisure time undertaking golf related practice and from 16.1 years of age ($SD = 2.2$) they also engaged in non-golf specific training practices (e.g., stretching, fitness).

**Golf Specific Activities**

Table 1 provides an overview of years in golf and total practice hours of the participants in the present study.

<table>
<thead>
<tr>
<th>Golfer</th>
<th>Years competing in golf</th>
<th>Total hours golf participation</th>
<th>Mean hours golf per year</th>
<th>Mean hours golf per week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8 (11–18)</td>
<td>5,032</td>
<td>629</td>
<td>12.1</td>
</tr>
<tr>
<td>2</td>
<td>11 (10–20)</td>
<td>12,016</td>
<td>1,082.4</td>
<td>21.0</td>
</tr>
<tr>
<td>3</td>
<td>10 (12–21)</td>
<td>10,588</td>
<td>1,058.8</td>
<td>20.4</td>
</tr>
<tr>
<td>4</td>
<td>11 (11–21)</td>
<td>6,224</td>
<td>568.9</td>
<td>10.9</td>
</tr>
<tr>
<td>5</td>
<td>12 (7–18)</td>
<td>4,460</td>
<td>371.7</td>
<td>7.1</td>
</tr>
<tr>
<td>6</td>
<td>8 (9–16)</td>
<td>8,466</td>
<td>1,058.3</td>
<td>20.4</td>
</tr>
<tr>
<td>7</td>
<td>13 (9–21)</td>
<td>10,572</td>
<td>813.2</td>
<td>15.6</td>
</tr>
<tr>
<td>8</td>
<td>8 (9–16)</td>
<td>5,004</td>
<td>625.5</td>
<td>12.1</td>
</tr>
<tr>
<td>Mean</td>
<td>10.125</td>
<td>7,795</td>
<td>776.9</td>
<td>14.95</td>
</tr>
</tbody>
</table>
Figure 1 shows the performance development of the participants expressed as their annual handicap. Annual golf handicap scores revealed individuals performance levels generally advanced gradually year on year after initial progression plateau after approximately 4 years.

Figure 2 demonstrates the development of the training resources, the physical effort, mental effort and fun experienced during the golfing career to date. Figure 3 highlights how time spent undertaking golf specific provision increased annually in a non linear fashion. Larger step wise increments were encountered aged approximately 16 after commitment to deliberate practice activities and completion of secondary education.

**Psychosocial Influences**

For all golfers, an important motive to take up golf was their father. Although fathers played a range of sports recreationally throughout their lives they were all single figure handicap golfers ($M = 7.4$) at the time of data collection. Fathers also undertook a combined coaching and mentor role that increased in capacity until selection for county squads and exposure to qualified coaches aged approximately 14. During all stages of development, participants were heavily reliant on their parents for pastoral and financial support. Once established EGU squad players, participants had limited interaction with school friends and associates external to golf and tended to socialise with fellow elite sports performers who were generally older EGU squad and professional golfers. Likewise, professional standards, preparation for training and competitions and post practice and competition reflections became meticulous.
Figure 2. Mean annual ratings (0–10) for training resources, physical effort, mental effort and fun experienced during the participants golf career.

Figure 3. Annual participant engagement within golf activities.
Discussion

Limited research has examined factors that contribute towards the development of golfing excellence. Therefore, in an effort to establish which factors might be important to achieve elite status in golf, the aim of this study was to examine the nature of developmental, psychosocial and contextual factors experienced by elite adolescent golfers. In addition, we examined which theory is better in explaining developmental pathways in golf, deliberate practice theory or DSMP.

Demographics

All participants in the study were from middle to upper socio economic backgrounds. This finding mirrors a body of research emphasising how children from middle class backgrounds participate within more sporting activities and receive additional support to do so from family members in comparison with children from lower-income families (Lin-Yang, Telama, & Laakso, 1996; Van Deventer, 2000; Zeijl, TePoel, Du Bois-Raymond, Ravesloot, & Meulman, 2000). Furthermore, research by Rowley and Graham (1999) established excessive time demands and financial cost of participation in training led to drop out of children from predominantly working-class and single-parent families. In short, individuals from higher socioeconomic status backgrounds experience greater opportunity and support to continue participating in sport throughout their lives.

Research by Bloom (1985) and Cote (1999) also emphasised the influence of the family at contrasting periods throughout children's talent development across a range of domains. Their research demonstrated how internationally recognised performers experienced significant parental support and were normally introduced to a particular activity by their parents.

A developing argument within the talent development literature suggests being raised away from major city centres is advantageous to developing both superior sporting performance and long term participation in later life. Cote, Macdonald, Baker and Abernethy (2006) examined the population size of where elite sports performers resided during their childhood and adolescent years and found living in a city with a population of less than 500,000 inhabitants significantly increased the possibility of becoming an elite athlete in later life. It appears that the size of the city where athletes gain their formative experience has a considerable influence on numerous issues including how they are initially exposed to sports, their long term performance, participation, and personal development. All participants in the present study lived in the same location for all of their lives, which tended to be located in relatively sparsely populated rural areas. The participants also lived close to a local golf course of which the father was a member.

One of the few studies to examine the development of elite golfers found that 75% of participant's fathers played golf during their childhood and 70% had a handicap of 12 or below. Also, the majority of participants started playing golf aged ten and went on to engage within long term golf specific deliberate practice activities during late adolescence (Zaichkowesky & Morris, 2002). These conclusions are supported by the findings of this study as fathers were competent golfers, who played and practiced regularly, provided strong encouragement to pursue the game of golf and regular teaching/coaching points up to late adolescence.

Early Activity Involvement

Long term exposure to repetitious golf training was not a prerequisite for achieving international adolescent status as participants did not engage exclusively within golf during their childhood and adolescence. An absence of structured golf specific training protocols during childhood and early teenage years was evident, as participants were also involved with a variety of other sports, where golf was one in a playful,
developmentally supportive environment. This pathway continued until selection for regional and international representative golf squads during the late teenage years. Also, in agreement with Vaeyens, Gullich, Warr and Philippaerts (2009), participants did not display significant signs of promise during their childhood and early adolescent years. This finding lends support to the idea that exceptional abilities at a young age are not a necessary precondition for later success.

It must also be stressed that participants experienced unique developmental journeys on their way to adolescent golfing excellence. The distinctive non-linear pathway opposes the assumptions of well accepted talent development models such as Long Term Athlete Development (Balyi, 2001) and the assertion that the pathway to excellence is a linear process. This was evident in the development of the participants’ golf-handicap. Participants experimented in various sports which appeared crucial for the development of adolescent excellence. However, there were variations between the nature and duration of early activity involvements undertaken by participants during their sporting careers to date. Like the studies by Ollis, Macpherson and Collins (2006), and Philips, Davids, Renshaw and Portis (2010), no two participants were found to have followed an identical developmental route to excellence with many engaging in a multitude of team and individual sporting activities at a range of standards.

Developmental Milestones

The present study did not support deliberate practice theory as engagement within ten years sustained golf practice was not a necessary requirement for acquiring adolescent excellence. Specifically, participants did not follow an early specialisation trajectory and refrained from engagement within long-term golf specific deliberate practice until they decided to specialise in golf and only after it became their sole purpose in life at approximately 16 years of age. Instead, participants encountered a playful introduction to several sporting activities within a developmentally supportive environment until selection for EGU international representative teams during late adolescence. These findings parallel recent studies (Baker et al., 2003; Baker et al., 2005; Berry et al., 2008; Cote, Horton, MacDonald, & Wikes, 2009; Johnson et al., 2008) which suggest as a substitute to deliberate practice, aspiring adolescent sports performers should be exposed to playful, non competitive learning environments that foster involvement within a diversity of sports in order to develop children’s intrinsic motivation and motor skills in preparation for transition into their adult sporting careers.

Golf Specific Activities

Ten years experience instead of ten years deliberate practice appears fundamental to developing adolescent golfing excellence. The findings of this study demonstrate similarity with existing research in that although participants had experience of playing their primary sport (golf) for between eight and ten years, the majority of this time was spent undertaking playful practice and competitions. Similarly, after ten years involvement in soccer (Helsen et al., 1998) and wrestling (Hodges & Starkes, 1996), participants went on to achieve international selection after accumulating approximately 4,000 and 6,000 hours of sport specific practice respectively. The study by Baker et al. (2003) found that selected Australian athletes achieved national team selection after only 4,000 hours of sport-specific practice during a 13 year time period, whilst one participant achieved national selection after only 6 years experience and 600 hours of participation in their sport.

A regular finding within the talent development literature is the increases in annual training volumes of those who are on the path of achieving excellence (Starkes, 2000). Participants in the present study reported spending on average five hours per week undertaking golf related activity for the first two years of their sports involvement. After
approximately eight years, average weekly practice volumes ranged between 25 and 30 hours per week. Once the decision to specialise in golf was made, aspects of participants' daily lives were sacrificed to cater for the demands of extended deliberate practice; as they grew older they become increasingly committed and self-determined in their pursuit of golfing excellence (e.g. Cote et al., 2009; Jess, Dewar, & Fraser, 2004; Schoon, 2000; Soberlak & Cote, 2003; Treasure, 2001).

**Psychosocial Influences**

A recurrent finding in previous research (e.g. Cote, 1999; Durand-Bush & Salmela, 2002; Gould, Dieffenbach, & Moffett, 2002; Keegan, Spray, Harwood, & Lavallee, 2010; Vernacchia, McGuire, Reardon & Templin, 2000) suggests the development of sporting excellence requires long-term social support from various sources. Consistent with this literature, the roles undertaken by parents and in particular fathers who were found to provide financial, emotional and practical support were evident. Although previous research emphasizes the critical role of coaches in youth sport development systems (Cote & Fraser-Thomas, 2007; Fraser-Thomas et al., 2008; Macphail & Kirk, 2006; Wiersma, 2000; Zaichkowsky & Haberl, 1999), in this study participants did not receive professional golf coaching until selection for county representative teams was established, which tended to occur between 14 and 16 years of age. The emergence of day to day coaching roles undertaken by fathers throughout their child's golf career until selection for EGU squads expands on previous research (e.g. Holt, Tamminen, Black, Sehn, & Wall, 2008; Horn & Horn, 2007; Kay, 2000; Wolfenden & Holt, 2005) that examined the role of family in long-term athlete development and highlights the reliance the golfers placed upon their fathers within the context of their golf development.

**Limitations**

A cautionary note about the retrospective paradigm employed in this study must be acknowledged. Data were not compared to official statistical records, developmental pathways of existing elite senior level golfers who compete on international standard golf circuits or interviews with parents or coaches. Ideally, this study may have utilised a longitudinal design to track the nature of golf provision undertaken by current elite adolescent golfers instead of relying on retrospective recall. Future longitudinal research that tracks developmental processes experienced by current and aspiring elite adolescent golfers as they unfold is warranted. The argument that participants have not yet actually achieved excellence as they were competing at elite adolescent and not elite senior levels must also be stressed. Considering the nature of daily golf provision up to selection for EGU squads and mean age once commitment to deliberate practice was made (approximately 16 years), it seems logical that several more years of deliberate practice may be required to display the hallmarks of elite senior status at which time participants would be aged 25–28. If that was found to be the case, it would imply participants had undertaken approximately ten years highly specialised golf training and would lend support to the deliberate practice model in the acquisition of senior level golfing excellence.

**Conclusion**

The evidence in this study suggests long term deliberate practice is not an essential requirement for the attainment of excellence as an adolescent sports performer. Alternatively, international adolescent golfing status appears to arise through the interaction of developmental, familial and contextual factors as opposed solely to high volumes of specialised golf training from an early age. The findings of the study lend support to the theories of early diversification and deliberate play but also acknowledge the critical role that deliberate practice has to offer as a key catalyst in the transition from
elite adolescent to senior level competitor. These findings are comparable with the recommendations made by Cote and colleagues in recent years who advocate young aspiring sports performers up to the age of approximately 16 should experience multiple sports within a non-competitive, task orientated, fun based learning environment that facilitates the refinement of motor skills as opposed to deliberate practice. Participants did not demonstrate any striking indications of golf supremacy until late teenage years which implies extraordinary golfing skills and accomplishments as a youngster are not necessary requirements for success in later life.

These findings may provide coaches and policy makers working in golf talent development systems with stronger evidence for designing interventions that may be more appropriate for meeting the needs of aspiring elite golfers in the future.

References


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The Role of Self-Regulatory Skills in Sport and Academic Performances of Elite Youth Athletes

Laura Jonker1*, Marije T. Elferink-Gemser1,2 and Chris Visscher1,2

Abstract: Success in sport and school is related to self-regulation. Additionally, sport experts are high academic achievers. We examined the role of 6 self-regulatory skills in the sport and academic performances of elite youth athletes (12-16 years) and compared their scores with age-matched controls in 2 academic secondary school systems (pre-university vs. pre-vocational). Pre-university students outscored pre-vocational students on 5 self-regulatory skills in the control group while 2 skills were significant in an athletes’ population. When comparing elite athletes to controls within each academic system, 3 self-regulatory skills were significant. Moreover, pre-vocational athletes outscored pre-university controls on 1 skill. These results expand theories of transfer by suggesting that self-regulation may help elite youth athletes to combine a sport career with education.

Keywords: talent development, metacognition, motivation, sport, academics

Even though elite youth athletes are frequently under excessive time pressure as a consequence of having to juggle their academic careers with their extensive investment in sports, they still tend to be high academic achievers (Brettschneider, 1999; Durand-Bush & Salmela, 2002). Student athletes generally have superior graduation rates (Watt & Moore, 2001) and are also more frequently in the pre-university system than fellow students who are less athletic (Jonker, Elferink-Gemser, & Visscher, 2009). In The Netherlands, students can enter two academic systems: the pre-university system or the pre-vocational system. The former prepares students for a university career and students are granted admission based on their test scores, while the latter prepares students for later vocational education. The academic system students enter thus determines their level of graduation and thereby their future career prospects. Within each academic system students can fail classes, which in The Netherlands means that students have to re-take the entire year.

Self-regulation is important in both sports and secondary education. Expert athletes exhibit more self-regulatory skills than non-experts in sports (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002), and at the higher academic levels typically more students can be found with superior self-regulatory skills (Zimmerman, 1986; Zimmerman & Martinez-Pons, 1986). It has, therefore, been suggested that the possession and use of self-regulatory skills predicts academic achievement (Nota, Sorens, & Zimmerman, 2004; Zimmerman & Martinez-Pons). The question arises whether self-regulatory skills may contribute to elite youth athletes’ academic performances as well as to their sport performance.

There is a long history of debate regarding the generality vs. domain-specificity of self-regulation and the possibilities for learners to use self-regulatory skills gained in one domain to progress in another (i.e., possibility for transfer). There is evidence for transfer failure and transfer success (e.g., Boekaerts & Corno, 2005; De Corte, 2003; Veenman, Eishout, & Meijer, 1997; Veenman & Spaans, 2005). This inconsistency in data may be due

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to how a successful transfer is conceptualized (De Corte; Veenman & Spaans). The traditional approach takes a narrow view for evidence of transfer (i.e., independent and instant use of knowledge and skills obtained in one domain transferred to another domain), whereas more recent conceptualizations emphasize a broader view (i.e., knowledge, skills and motivations obtained in one domain foster the use of skills in another domain) in which self-regulatory skills play a role (De Corte). Nevertheless, it is assumed that successful transfer is related to a similarity and to familiarity with the elements of a task (De Corte; Eccles & Feltovich, 2008; Pressley, 1995; Zimmerman, 1995).

Based on the broader conceptualization of transfer, the idea was to investigate the use of self-regulatory skills as potential moderators between excellent sport achievement and academic achievement in elite youth athletes (Jonker et al., 2009). Even though there seems to be little overlap between the respective elements of sport and academic performances, the factors that contribute to success in both domains may be highly correlated and have a common basis, namely a general set of self-regulatory skills. It has been proposed that elite athletes are familiar with the use of self-regulatory skills because of their familiarity with the domain-specific knowledge (i.e., declarative and procedural) that serves as a basis for self-regulatory skills. Additionally, elite youth athletes understand that they must be self-aware, goal-oriented and problem-focused to study and achieve their goals within various performance domains (Ericsson, Krampe, & Tesch-Römer, 1993; Kirschenbaum, 1984; Winne, 1995). These characteristics are consistent with the top-down approach of self-regulation in which students adopt their learning goals (Boekaerts & Corno, 2005).

In the present study we relied on Zimmerman’s self-regulated learning theory (1989, 2000, 2006) and the expert learning model of Ertmer & Newby (1996). Zimmerman (1986, 1989, 2006) defined self-regulation as the degree to which learners are metacognitively, motivationally and behaviourally proactive participants in the learning process. As a result, metacognition is defined as awareness of and knowledge about one’s own thinking and the skills of planning, self-monitoring, evaluation and reflection were adopted (Ertmer & Newby, 1996; Zimmerman, 1986, 2006). Zimmerman’s (2000) self-regulation theory distinguishes three cyclical phases of self-regulation: a forethought phase (i.e., goal setting and planning), a performance phase (i.e., use of strategies to improve the quality and the quantity of learning) and a reflection phase (i.e., strategies that include evaluating different parts of the performance after learning). The expert learning model of Ertmer & Newby was based on Zimmerman’s work, but emphasizes the importance of reflection. These authors describe reflection as the active process of individuals learning from past experience and applying prior knowledge and experience to improve current or future actions (Ertmer & Newby).

Students or athletes not only have to possess the above mentioned metacognitive skills, they also need to be motivated to use them (Zimmerman, 1989, 2006). Motivation is defined as the degree to which learners are self-efficaciously, autonomously, and intrinsically motivated to achieve a specific goal and includes effort and self-efficacy (Hong & O’Neil Jr., 2001). Furthermore, learners not only need metacognition and motivation, they must also use these skills within particular situations (Hong & O’Neil Jr.; Zimmerman, 1990).

In sum, previous studies report that elite youth athletes are not only high athletic performers, but are also high academic achievers. Sport experts outperform non-experts.
on self-regulation, which is a prerequisite for success at school as well (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002; Nota et al., 2004). Therefore, our aim was to examine the role of self-regulatory skills in the sport and academic performances of elite youth athletes. We compared elite youth athletes and non-athletes on six self-regulatory skills (i.e., planning, self-monitoring, evaluation, reflection, effort and self-efficacy) in the pre-vocational and pre-university systems. We hypothesized that students in the pre-university system would outscore their pre-vocational peers in self-regulatory skills (Cleary & Zimmerman; Kitsantas & Zimmerman; Nota et al.). Furthermore, because sport participation seems to promote self-regulatory skills (Pintrich & Zusho, 2002), and because international elite youth athletes are more reflective when compared with those at national level (Jonker, Elferink-Gemser, & Visscher, 2010), we expected elite youth athletes to score high on self-regulation, including reflection, independent of the academic system. We also wished to determine whether elite youth athletes in the pre-vocational system displayed higher levels of self-regulation than their pre-university non-athletic peers. Personal characteristics such as age, gender and socioeconomic status (SES) were taken into account. Prior research showed that older students are generally more self-regulatory than their younger counterparts (Al-Hilawani, 2003; Pintrich & Zusho; Zimmerman & Martinez-Pons, 1990). Furthermore, inconsistent findings have been reported in the use of self-regulatory skills between males and females (Anshel & Porter, 1996; Zimmerman & Martinez-Pons), and students lower in SES are associated with lower levels of sports participation, lower levels of self-regulation and more academic problems (Nota et al.; Sirin, 2005).

Assessing the role of self-regulatory skills in the sport and academic performances of elite youth athletes may provide insight regarding the possibility that these athletes utilize self-regulatory skills not only in sports, but also in the academic setting. This insight may help elite youth athletes to combine sport with educational responsibilities, and the combination of these two factors is especially important for athletes aged 12 to 16 years. At this age, athletes have to improve most to reach senior elite levels of competition, but this age is also a period of immense pressure at school (Brettschneider, 1999).

**Method**

**Participants**

A total of 160 male and 178 female students (n=338) aged between 12 and 16 years participated in this study. Altogether, 170 were classified as elite youth athletes (77 male and 93 female; age: M=14.18 yrs, SD=1.17) on the basis of their participation in a talent development program in The Netherlands. This means that they were considered to belong to the best 2.5% of athletes in their age category. About half (n=83) played team sports (i.e., baseball, basketball, handball, field-hockey and volleyball) while the other half (n=87) took part in individual sports (i.e., gymnastics, judo, speed-skating, swimming, and tennis). The elite youth athletes had approximately 4000 hours of accumulated sport experience (M=4084.45, SD=1576.45). This is equal to approximately 560 hours of training practice per year (M=588.30, SD=185.25). Additionally, 78.8% of the athletes (n=134) were part of the pre-university system and 21.2% of them (n=36) were in the pre-vocational system.

The other 168 students (83 male and 85 female; mean age=14.26 yrs, SD=1.18) were designated as non-athletes based on their self-reported activities (i.e., they reported that they were not active in sports at the time of measurement and had a maximum of four years of sport experience in the past). Within this population of non-athletes, 47.6% of them (n=80) were part of the pre-university system and 52.4% of them (n=88) were in the pre-vocational system. Table 1 shows the general characteristics of the study groups.
Table 1. Mean Age, Number of Training Hours per Week, Number of Games per Week (and Standard Deviations), Gender, Socioeconomic Status (SES), and Re-taking an Entire Year of Study (n[%]) for the Elite Youth Athletes and the Non-Athletes in the Pre-University or Pre-Vocational Academic System

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Pre-university Elite youth athletes (n=134)</th>
<th>Pre-university Non-athletes (n=80)</th>
<th>Pre-vocational Elite youth athletes (n=36)</th>
<th>Pre-vocational Non-athletes (n=88)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>14.19</td>
<td>1.21</td>
<td>14.39</td>
<td>1.22</td>
</tr>
<tr>
<td>Training (hrs/week)</td>
<td>10.91</td>
<td>3.74</td>
<td>0.00b</td>
<td>0.00</td>
</tr>
<tr>
<td>Games (hrs/week)</td>
<td>3.84</td>
<td>3.09</td>
<td>0.00b</td>
<td>0.00</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>62</td>
<td>53.7</td>
<td>40</td>
<td>50.0a</td>
</tr>
<tr>
<td>Female</td>
<td>72</td>
<td>46.3a</td>
<td>40</td>
<td>50.0a</td>
</tr>
<tr>
<td>SES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>6</td>
<td>4.5a</td>
<td>3</td>
<td>3.8a</td>
</tr>
<tr>
<td>Middle or high</td>
<td>128</td>
<td>95.5</td>
<td>77</td>
<td>96.2</td>
</tr>
<tr>
<td>Re-take an entire year (n[%])</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>123</td>
<td>91.8a</td>
<td>61</td>
<td>76.2b</td>
</tr>
<tr>
<td>Once or more</td>
<td>11</td>
<td>8.2</td>
<td>19</td>
<td>23.8b</td>
</tr>
</tbody>
</table>

Note. Within each row, means having the same letter in their superscripts are not significantly different from each other at the .05 level.

Instruments

To obtain the demographic details of the participants and to assess their involvement in sports and their self-regulatory skills, all participants completed a questionnaire specially compiled for this study.

General Questions. Participants noted their date of birth, gender, and the 4-digit zip code of their place of residence. The 4-digit zip code was compared to a list published by the Dutch Ministry of Housing, Spatial Planning and the Environment specifying Dutch neighbourhoods low in socioeconomic status (SES). SES refers to an aggregate standard for the household family income, education, occupation and residential neighbourhood. As it is assumed that people with a middle or high SES are sufficiently able to participate in sports and have similar academic propositions, we used SES as a dichotomous variable (i.e., low vs. middle or high in SES). Participants also stated which sports they were involved in, the number of hours spent on training and games, the number of years they had been active in sports and whether they have ever had to re-take a full year of study. Whether the participants were registered in the pre-university or pre-vocational system was recruited from the schools' databases.

Self-Regulation Items. The six aspects of self-regulation were assessed using subscales from several existing questionnaires (Herl et al., 1999; Hong & O’Neil Jr., 2001; Howard, McGee, Sia, & Hong, 2000; Peltier, Hay, & Drago, 2006; see below). The subscales were translated from the originals in accordance with the procedures described by Pelletier and colleagues (1995). First, two native speakers of Dutch proficient in English translated the original English subscales into Dutch. The Dutch translations were then back-translated into English by two other bilingual individuals who had no knowledge of the original subscales. The resultant translations were evaluated by all translators and a Professor in Human Movement Sciences, which led to seven minor linguistic modifications. This version was tested on 48 children aged 11 to 14 years, the youngest age band in our target group, who were asked to express what was too difficult. Based on their comments we made some final linguistic modifications to increase the intelligibility of the items.
With respect to the reliability and validity of the questionnaire, we performed a confirmatory factor analysis among 601 adolescents who were between 11 and 17 years of age. Multiple conventional criteria were used to evaluate our results (i.e., comparative fit index [CFI] and non-normed fit index [NNFI]> .90, root mean square error of approximation [RMSEA]< .08, and standardized root mean residual [SRMR]< .08; Byrne, 1998; Hu & Bentler, 1999). The results of our factor analysis were: CFI=.95, NNFI=.94, RMSEA=.060, SRMR=.063, and we concluded that the factor analysis showed satisfactory results for an adjusted six-factor model. A second confirmatory factor analysis (n=600) cross validated these results. Additionally, Cronbach's alphas for each scale in the current study ranged from α=.76 on self-monitoring to α=.88 on effort which is considered acceptable (i.e., >.70; Nunally, 1978), and consistent with the original studies (i.e., Cronbach's alphas between α=.72 and α=.85; Herl et al., 1999; Hong & O'Neil Jr., 2001; Howard et al., 2000; Peltier et al., 2006).

**Planning, Self-Monitoring, Effort, and Self-Efficacy.** The subscales for planning, self-monitoring, effort and self-efficacy were adapted from Hong and O'Neil Jr. (2001) and Herl and colleagues (1999). All subscales consisted of 6 to 10 items and participants needed to rate each item on a 4-point Likert type scale ranging from 1 (almost never) to 4 (almost always). High scores on these four self-regulation subscales indicated a high level of metacognitive and motivational self-regulation in general task situations. The planning scale gauges the respondent's awareness of the demands of a task prior to its execution, and an example of a question reads, "I determine how to solve a problem before I begin". The self-monitoring scale evaluates the awareness the respondent has of his or her actions during task execution (e.g., "I keep track of my progress"), while the effort scale measures the respondent's willingness to apply himself or herself to attaining the set goal (e.g., "I work as hard as possible on all tasks"). Self-efficacy, which is how the respondent judges his or her capabilities to organize and execute the required actions, was assessed using the Generalized Self-Efficacy scale. An example response on this scale would be "No matter what comes my way, I am usually able to manage it" (Hong & O'Neil Jr, 2001; Schwarzer & Jerusalem, 1995). While the authors are aware that there are separate domain-specific self-efficacy scales for sports and academic performance (Bandura, 1997), we used a general measure to be consistent with the other subscales. Using a general measure for self-efficacy is less accurate but can be valuable as well (Bandura).

**Evaluation.** The eight-item Inventory of Metacognitive Self-Regulation (IMSR) subscale, developed by Howard and colleagues (2000), was used to examine evaluation. Evaluation is the ability to assess both the processes employed and the finished product after task completion. An example question is, "I go back and check my work". Participants responded to each item on a 5-point Likert scale that ranged from 1 (never) to 5 (always). A high score on the evaluation scale indicated that the respondent often evaluated his or her performance.

**Reflection.** The five-item Reflective Learning Continuum (RLC), by Peltier and colleagues (2006), was used to measure the extent to which respondents are able to appraise what they have learned and to adapt their past knowledge and experiences to improve performance. An example of a question is, "I often reappraised my experiences so I can learn from them". Because the items in the original subscale were written in the simple past tense, we changed the subscale into the simple present tense in order to maintain consistency with the other five subscales. Items were rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). Accordingly, low scores on the RLC indicated a high level of reflection. We reversed the scores for our analyses, such that high scores on this subscale indicated a high level of reflection.
Procedure
All of the participants were informed about the study's procedures and provided their verbal consent to participate. Written informed consent was obtained from their parents and the schools the participants attended. The participants filled out the questionnaire in a group setting during their regular school activities while in the presence of test leaders. The assessment occurred during the competitive season (i.e., March to May). The procedures were in accordance with the standards of the local medical ethics committee at the leading institution.

Analyses
Analysis of the data was conducted using SPSS 17.0. Descriptive statistics were calculated for the six self-regulatory skills (planning, self-monitoring, evaluation, reflection, effort and self-efficacy) for the elite youth athletes and the non-athletes according to the academic system they are involved in (pre-vocational or pre-university). To interpret the scores, effect-size correlations (r) were calculated. An effect size of approximately .100 was considered small, .243 moderate, and .371 large (Rosenthal & Rubin, 2003).

Five separate Hotelling's $T^2$ tests were performed. Hotelling's $T^2$ tests have been shown to be more powerful in detecting small reliable changes when compared to the power of adjusted univariate techniques (Davidson, 1972). The first Hotelling's $T^2$ test compared the pre-university non-athletes to their pre-vocational non-athletic peers and was performed to assess the role of being part of the pre-university or pre-vocational system. The scores on the six self-regulatory subscales served as dependent variables and academic system as independent variable.

The second Hotelling's $T^2$ test compared the elite youth athletes in the pre-university system to their non-athletic counterparts in this type of education. A similar Hotelling's $T^2$ test was conducted to assess differences in self-regulation between elite youth athletes in the pre-vocational system and their pre-vocational non-athletic peers. In both analyses, self-regulation served as the dependent variable and competitive level as the independent variable. These analyses were performed to assess the role of competitive level in the self-reported use of self-regulation, given that all athletes were part of the same academic system.

The fourth Hotelling $T^2$ test, was performed to evaluate the role of academic performance in a population of elite youth athletes. The scores on self-regulation served as the dependent variables while academic system served as the independent variable. The final Hotelling's $T^2$ test was performed to assess possible differences in self-regulation between the elite youth athletes in the pre-vocational system and the non-athletes in the pre-university system. Again, scores on the six subscales of self-regulation were considered the independent variables while the combined sports and academic levels were the independent variables.

In all five analyses, age, gender, SES and re-taking a year of study served as covariates. Correlational analyses (Pearson's r) revealed a weak positive relationship between competitive level and repeating class, r(336)=.176; p=.001, and between academic system and SES, r(336)=.265; p<.001. A weak negative relationship existed between academic system and repeating class, r(336)=-.128; p=.018. When the Hotelling's $T^2$ tests yielded significant effects, the univariate results were interpreted. For all tests of significance, an alpha level of .05 was adopted and the Bonferroni method was used to correct for multiple testing.

Results
Mean scores and standard deviations on the six self-regulatory skills for competitive level and academic system are presented in Table 2 as well as the corresponding effect sizes (r).
Table 2. Adjusted Mean Scores (M), Standard Errors (SE) and Effect Sizes (r) in Order of the Hotelling $T^2$ Tests on the Six Self-Regulatory Skills for the Elite Youth Athletes and the Non-Athletes in the Pre-University or Pre-Vocational Academic System

<table>
<thead>
<tr>
<th></th>
<th>Pre-university</th>
<th></th>
<th>Pre-vocational</th>
<th></th>
<th>Effect sizes for $T^2$ analyses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n=134)</td>
<td></td>
<td>(n=36)</td>
<td></td>
<td>First</td>
<td></td>
</tr>
<tr>
<td>Elite youth athletes</td>
<td></td>
<td></td>
<td>Non-athletes</td>
<td></td>
<td>$T^2$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SE</td>
<td>M</td>
<td>SE</td>
<td>M</td>
<td>SE</td>
</tr>
<tr>
<td>Planning (Range 1-4)</td>
<td>2.88a</td>
<td>.045</td>
<td>2.49b</td>
<td>.060</td>
<td>2.39b</td>
<td>.063</td>
</tr>
<tr>
<td>Self-monitoring (Range 1-4)</td>
<td>2.80a</td>
<td>.045</td>
<td>2.67a</td>
<td>.060</td>
<td>2.72a</td>
<td>.081</td>
</tr>
<tr>
<td>Evaluation (Range 1-5)</td>
<td>3.55a</td>
<td>.044</td>
<td>3.33a</td>
<td>.061</td>
<td>3.39a</td>
<td>.068</td>
</tr>
<tr>
<td>Reflection (Range 1-5)</td>
<td>4.17a</td>
<td>.043</td>
<td>3.86b</td>
<td>.067</td>
<td>4.13c</td>
<td>.096</td>
</tr>
<tr>
<td>Effort (Range 1-4)</td>
<td>3.04a</td>
<td>.045</td>
<td>2.69b</td>
<td>.058</td>
<td>2.86b</td>
<td>.084</td>
</tr>
<tr>
<td>Self-efficacy (Range 1-4)</td>
<td>2.98a</td>
<td>.037</td>
<td>2.89ab</td>
<td>.048</td>
<td>2.80b</td>
<td>.070</td>
</tr>
</tbody>
</table>

Note. r around .100 (small$^*$), r around .243 (moderate$^{**}$), r around .371 (large$^{***}$)
Within each row, means having the same letter in their superscripts are not significantly different from each other at the .05 level.

The pre-university non-athletes are not significantly different from the pre-university elite youth athletes and from the pre-vocational elite youth athletes.

Self-Regulatory Skills and Academic System

The results of the first Hotelling's $T^2$ test revealed that the pre-university non-athletes had higher scores on self-monitoring, $F(1,162)=15.294$, $p<.001$, $r=.290$, evaluation, $F(1,162)=16.684$, $p<.001$, $r=.302$, reflection, $F(1,162)=9.106$, $p=.003$, $r=.228$, effort, $F(1,162)=10.299$, $p=.002$, $r=.242$, and self-efficacy, $F(1,162)=10.339$, $p=.002$, $r=.242$ than their non-athletic peers in the prevocational system. The corresponding effect sizes were considered moderate. No significant result was found on planning ($p>.05$) and the effect size was considered small (Table 2). In addition, no significant effects were found for the covariates age, gender, SES and re-taking a year of study ($p>.05$).

Self-Regulatory Skills and Competitive Level

The results of the second Hotelling's $T^2$ test showed that the pre-university elite youth athletes outscored the non-athletes in this educational system on planning, $F(1,208)=7.245$, $p=.008$, $r=.182$, reflection, $F(1,208)=19.473$, $p<.001$, $r=.290$, and effort, $F(1,208)=18.989$, $p<.001$, $r=.287$. The corresponding effect sizes were considered small-to-moderate on planning and moderate on reflection and effort. No significant differences were found on self-monitoring, evaluation and self-efficacy ($p>.05$), as well as small effect sizes (Table 2). In addition, the covariate age turned out to be significant, showing that older participants reported lower scores on effort than their younger counterparts, $F(1,162)=9.106$, $p=.003$. The covariates gender, SES and re-taking a year of study yielded no significant results ($p>.05$).

Within the pre-vocational system, the results of the third Hotelling $T^2$ test revealed that the pre-vocational elite youth athletes outscored the pre-vocational non-athletes on self-monitoring, $F(1,118)=12.313$, $p=.001$, $r=.303$, reflection, $F(1,118)=24.570$, $p<.001$, $r=.409$, and effort, $F(1,118)=18.315$, $p<.001$, $r=.361$. The effect sizes were considered large. No significant effects were found on planning, evaluation and self-efficacy ($p>.05$). The effect sizes ranged from small to small-to-moderate (Table 2). The covariates age, gender, SES and repeating class yielded no significant results.
Self-Regulatory Skills, Competitive Level x Academic System

When assessing the value of the academic system the athletes are participating in (fourth Hotelling $T^2$ test), the results showed that the pre-university elite youth athletes had higher scores on planning, $F(1,164)=8.994$, $p=.003$, $r=.225$, and self-efficacy, $F(1,164)=5.392$, $p=.021$, $r=.176$ than the pre-vocational elite youth athletes. The effect sizes were considered moderate for planning and small-to-moderate for self-efficacy. No significant results were found on self-monitoring, evaluation, reflection and effort ($p>.05$), as well as small effect sizes (Table 2). In addition, the covariate age yielded a significant result; older athletes had lower scores on effort than younger athletes, $F(1,164)=3.582$, $p<.001$. The covariates gender, SES, and re-taking a year of study were not significant ($p>.05$).

The results of our fifth Hotellings $T^2$ test showed that the pre-vocational athletes had higher scores on reflection than the non-athletes in the pre-university system, $F(1,110)=5.692$, $p=.019$, $r=.218$ (Figure 1). The corresponding effect size was considered moderate. No significant effects were found on the other five aspects of self-regulation ($p>.05$) and the effect sizes were small (Table 2). The covariates yielded no significant effects ($p>.05$).

Discussion

We examined the role of six self-regulatory skills (i.e., planning, self-monitoring, evaluation, reflection, effort and self-efficacy) in the sport and academic performances of elite youth athletes. Insight into the value of sports participation at high competitive level and being involved in either the pre-university or pre-vocational system, may clarify the possibility that elite youth athletes utilize their well-developed sense of self-regulation not only in sports, but also in the academic setting.

![Figure 1](attachment:image.jpg)
That non-athletes in the pre-university system outscore their pre-vocational non-athletic counterparts on five out of six self-regulatory skills is in line with previous studies reporting that academically successful students are more likely to monitor, evaluate and reflect upon their performances, that they have a better developed sense of self-efficacy and that they are more willing to exert themselves than their less academically successful peers (Bandura, 1993; Ertmer & Newby, 1996). Within a population of elite youth athletes on the other hand, only two self-regulatory skills (i.e., planning and self-efficacy) are significant when pre-university athletes are compared to their pre-vocational counterparts. These combined findings suggest that participation in junior elite sports may play a role in the self-reported use of self-regulatory skills of elite youth athletes since smaller differences between the academic systems are found when students participate in junior elite sports.

We also observed that the elite youth athletes in the pre-university system outscore their pre-university non-athletic counterparts on three self-regulatory skills (i.e., planning, reflection and effort). A similar pattern was found when comparing elite youth athletes to non-athletes within the pre-vocational system (i.e., self-monitoring, reflection and effort). These results further emphasize the significance of the relationship between sports participation at junior elite level and scores on self-regulation. More specifically, even when the non-athletes are part of the pre-university academic system, in which they are suggested to have above average levels of self-regulation (Nota et al., 2004; Zimmerman, 1986; Zimmerman & Martinez-Pons, 1986), the elite youth athletes in this academic system report more frequent use of their planning and reflective skills and also report to make more effort to succeed. More practically this means that the elite youth athletes have an increased awareness of a task's demands prior to its execution and are more conscious of their previous performances from which they are able to learn (Ertmer & Newby, 1996; Peltier et al., 2006). Furthermore, they make more effort to succeed in achieving their goals (Hong & O’Neil Jr., 2001; Jonker et al., 2010; Toering, Elferink-Gemser, Jordet, & Visscher, 2009).

Within the broader concept of transfer, the results may suggest that elite youth athletes are able to use their well-developed self-regulatory skills in an academic setting as well. This may be reflected by the relatively high ratio of elite youth athletes in the pre-university system (i.e., 78.8%), whereas the percentage of the Dutch national average is far lower (i.e., 44.0%; CBS, 2008). Additionally, the percentage of elite youth athletes who have ever had to re-take a year of study is also significantly lower than for the non-athletes (i.e., 11.2% vs. 23.8% respectively; Table 1). This is consistent with previous research showing that approximately 70% of the elite youth athletes are in higher academic systems without other difficulties in class (Jonker et al., 2009). The relationship between self-regulation and involvement in junior elite sports seems to become more evident in the pre-vocational system. To elaborate, even though not all aspects reached values of significance, the effect sizes at this lower academic level are considerably larger than the effect sizes found in the higher pre-university system (Table 2). Again, these results provide support for the role of junior elite sports in the self-reported use of self-regulatory skills, irrespective of academic system. This verifies existing theories proposing that the sporting environment may form a suitable environment for the development and use of self-regulation due to its goal-directedness and richness of feedback (Boekaerts & Corno, 2005; Pintrich & Zusho, 2002).

Given the fact that the scores of the pre-vocational elite youth athletes are similar to those of the pre-university non-athletes, and that elite youth athletes in the pre-vocational system even display higher levels of reflection (Table 1), our results further emphasize the relationship between junior elite sports and increased use of self-regulatory skills. That the pre-vocational elite youth athletes outscore their pre-university non-athletic peers specifically on reflection was not unexpected. Two recent studies have emphasized the importance of reflection in talent identification and talent development (Jonker et al., 2010;
Toering et al., 2009). Reflection is referred to as a key characteristic in expert learning, enabling learners to change knowledge into action, which makes it possible for them to apply what they have learned in the past to new situations (Ertmer & Newby, 1996; Peltier et al., 2006). More specifically, the pre-vocational elite youth athletes are more involved in their learning processes and are trying to learn from past experiences to improve their future performances than their pre-university non-athletic counterparts are. As a consequence of the frequent use of reflective skills (i.e., mean scores above 4 on a 5-point Likert scale; Table 2), the elite youth athletes may profit more from the time they have spent in learning than non-athletes do (Ericsson, 2003; Jonker et al.; Toering et al.). Jonker and colleagues showed that the use of reflection may be particularly important at the highest levels of excellence in sports. We therefore recommend that future studies assess whether reflection may be a predictor for which elite youth athletes have the best potential to attain senior elite status.

Although our findings may suggest that involvement in junior elite sports may play a role in the development of self-regulation, it would be too ambitious to draw conclusions solely based on the result that elite youth athletes outscore non-athletes regardless of academic system, and that pre-vocational elite athletes are more reflective than pre-university non-athletes. While the sporting environment is rich in feedback and instruction and highly goal-directed, which can support the development of self-regulatory skills (Boekaerts & Corno, 2005; Pintrich & Zusho, 2002), it may also be the case that the elite youth athletes compete at these high competitive levels as a result of their frequent use of self-regulation, i.e., that they have an inborn ability to use their self-regulatory skills. We therefore suggest that future research examines this question of causality by using a longitudinal design or by intervention studies.

There are several limitations to this study. First, a self-report questionnaire was used which may be susceptible to socially desirable answers (Ericsson et al., 1993). Additionally, researchers also question the ability of individuals to report their cognitions accurately. However, the existence of valid self-report measurements has also been emphasized by others (Eccles, in press). With regard to the purpose of the present study, (i.e., to examine self-regulation in sport and academic performances of elite youth athletes), we consider the use of a questionnaire as most appropriate. Second, previous studies have shown that expertise in other domains such as music is also related to increased self-regulation (Nielsen, 2001). Although it would be interesting to assess the relationships between, for example, music, self-regulation and academic performance, we did not control for the role of other domains of expertise.

In conclusion, our results show that elite youth athletes possess well-developed self-regulatory skills, especially reflection, and support the value of participation in junior elite sport. More specifically, within either the pre-university or pre-vocational system, elite youth athletes reflect more on their past performance in order to learn and are making more effort to accomplish their tasks successfully. Moreover, the elite youth athletes in the pre-vocational system outscored their pre-university non-athletic counterparts on their ability to learn efficiently by means of reflection. As a consequence, they may benefit more from the time they spend on learning. Given that the ratio of elite youth athletes in the pre-university system is relatively high, we suggest that the use of self-regulatory skills may help elite youth athletes to combine their extensive investments in sports with their educational purposes. It is, however, not yet clear whether these levels of self-regulation are a result of being active in sports or that elite youth athletes are people who were born with those skills. Nonetheless, our findings have some preliminary implications for people directly or indirectly involved with young athletes. Encouraging athletes to apply their self-regulatory skills both inside and outside their sports may help them to balance their sports and academic activities in a better way and also support their education.
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References


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