

CHARACTERISTICS THAT TYPIFY SUCCESSFUL WORLD SKILLS

COMPETITION PARTICIPANTS

Petri Nokelainen

Pekka Ruohotie

University of Tampere, Finland

Contact person:

Dr. Petri Nokelainen

Research Centre for Vocational Education

P.O. Box 229

13101 Hämeenlinna

Finland

Email: petri.nokelainen@uta.fi

Internet: <http://www.uta.fi/u/petri.nokelainen>

Abstract

International career and technical skill competitions are gaining increasing interest across the world. In this paper, we study what kind of young individuals do take part in these competitions and for what reasons. The sample consists of eight successful World Skills Competition (WSC) participants and their personal trainers, work-life representatives and parents ($n = 30$). Research evidence was collected with a semi-structured interview. Following three research questions were formulated: 1) What personal characteristics typify a successful WSC participant?; 2) How the WSC participants' characteristics differ during training period, competitions and working life?; 3) What characteristics specify the WSC participants' initial interest towards the work field, perseverance in acquiring the skill and mastery of the skill? Results showed that the most important characteristics were: Self-reflection, volition, cognitive skills, motivation and social skills. Volitional characteristics were considered to be the most important in all three skill development stages (initial interest, perseverance, mastery). Also the importance of cognitive skills, self-reflection and motivation were mentioned. Further, institutions and trainers support were considered to be important throughout the three skill development stages. Especially the role of encouraging teachers was vital in the early stages of skill development. Future work possibilities played an important role in the mastery level, as success in competitions was reported to be directly related to future work offerings.

Introduction

International career and technical skill competitions (World Skills Competition, WSC) are gaining increasing interest across the world. What started in 1950 as a small regional competition in Spain, has now become a world-wide recognized event that draws participants and visitors all over the world. For example, when Finland hosted the 2005 World Skills competition in Helsinki, there was more than 40000 visitors per day watching 700 international experts working for a week on 45 skill categories. In the national level, SkillsUSA Championships have been held since 1967 and it has become a multi-million dollar event with more than 5200 contestants in 91 separate events.

Whether it is a national or international career and technical skill competition, there is this same basic formula involved: Students participate, schools (especially teachers) train them and industry finances most of the training and competitions. Questions like “Why this system works?” or “What are the essential benefits for all parties?” would call for a large multidisciplinary study, so we wanted to begin by hearing from various sources what kind of young individuals do take part in these competitions and for what reasons. Following three research questions were formulated: 1) What personal characteristics typify a successful WSC participant?; 2) How the WSC participants’ characteristics differ during training period, competitions and working life?; 3) What characteristics specify the WSC participants’ initial interest towards the work field, perseverance in acquiring the vocational skill and mastery of the skill?

Our sample consists of Finnish WSC participants representing four skill categories: 1) IT/Software Applications, 2) Web Design, 3) Plumbing, 4) Beauty Therapy. Eight participants

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together with their personal trainers, work life representatives and parents ($n = 22$) were interviewed with a semi-structured interview covering talent development (parental, school and training support) and intrapersonal issues (role of motivation, volition and self-reflection) in initial, perseverance and mastery stages of their skill development. In addition, 23 WSC participants responded to a questionnaire measuring motivation, self-regulation, social abilities, school and home atmosphere, and individual strengths. Although our design is based on a multi-method approach and, thus, cross-validation of both evidence sources, only interview results are reported in this paper.

Theoretical framework

The rationale for this study is that, in the work life, all the workers are required to have cognitive skills and take part in the decision making processes. With experts, those skills are interconnected with a high ability to analyze domain-specific information and understand the basics and the meanings of different work tasks (Ruohotie, 2004). Their cognitive processes are characterized by complexity of domain-specific knowledge structures and deep understanding of concepts (Pillay, 1998).

However, knowledge structures are different from declarative knowledge. The former relate to the analysis or parsing of information, whereas the latter describes the amount of knowledge or learned facts. The structure of knowledge stored in memory may be more important from the point of view of learning than the amount of it. Knowledge structures affect subsequent knowledge parsing and memory retrieval processes. The retrieval of information from memory speeds up and deepens understanding, helps in decision-making and the anticipation of future

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events, and makes it easier to find optimal solutions to problems. (Day, Arthur & Gettman, 2001.)

Experts also have the ability to apply their knowledge and skills to new tasks and situations. They are able to transfer information, such as knowledge of terminology and processes to new problem solving processes, for example, in the area of digital communication technology.

There is no denying that metacognitive skills are also needed in working life. According to Driscoll (2005, p. 107), “metacognition refers to one’s awareness of thinking and the self-regulatory behavior that accompanies this awareness.” Those experts who master their work, have the ability to analyze problems. They also are proactive, able to anticipate the development of their field and take responsibility for the effectiveness of their work practices. These higher level thinking skills are related to cognitive processes, such as critical thinking, problem solving and creative thinking. Those processes advance professional knowledge, deepen the understanding of knowledge and increase the transferability of knowledge and skills (Pillay, 1998). Trishman's research group (1993) found seven factors that promote higher level thinking: 1) Open-heartedness and broadmindedness; 2) Intellectual curiosity; 3) Inquisitiveness for connections and explanations; 4) Ability to anticipate outcomes and to make plans; 5) Ability to process information; 6) Ability to assess frameworks and reasons; 7) Ability to monitor one's own thoughts. It is sad to say, but individuals may have strong professional knowledge, but still have extensive shortcomings in their thinking skills.

Our conclusion at this point is that work life requires experts to own a strong professional knowledge, ability to transfer their skills and knowledge, and high metacognitive skills. In other words, they need to be both *competent* and *qualified*.

Competence is the potential capacity of an individual to successfully complete a certain task according to certain criteria set by someone else (Ellström, 1994). An interesting point is that a competence may also be seen as an attribute of the individual (i.e., ‘self-attribution’, see Heider, 1958), for example, referring to a human resource that the person brings to a mathematical problem solving situation (Nokelainen, Tirri & Merenti-Välimäki, 2007). Thus, according to Weiner (1986), self-attributions may emphasize potential competence as indicated by the capacity of an individual to successfully complete tasks and face new challenges on the basis of demonstrated personal attributes and abilities (other than those obtained through formal training).

Ellström (2001) defines qualification as a competence that is actually required by a work task and/or is implicitly or explicitly determined by individual qualities. He has noticed that potential competence may vary greatly between individuals with the same formal qualifications, because they may possess very different levels of inherent ability and may have learned different things outside of school or studies through their working life and recreational activities. Williams (2002, p. 103) has defined these efficiency beliefs as follows: “Trust in one's abilities to plan and execute the activities that lead towards a skilful accomplishment.” Thus, self-attributions affect later performance expectations and, in negative cases, the development or continuation of learned helplessness (Ruohotie & Nokelainen, 2000).

In this study, we apply Zimmerman’s model of self-regulation where the term ‘self-regulation’ refers to the process through which self-generated thoughts, feelings, and actions are planned and systematically adapted as necessary to affect one’s learning and motivation (Schunk & Ertmer, 2000; Zimmerman, 2000). Zimmerman (1998) describes self-regulation of learning tasks as a cyclical, three-phase process. The phases in this learning cycle are forethought, performance or volitional control, and self-reflection (Figure 1).

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-- Insert Figure 1 about here --

Theoretical framework of self-regulation in vocational learning is summarized in Figure 2 (Nokelainen, 2008). The figure represents self-regulation as a system concept (Boekaerts & Niemivirta, 2000) managing leadership behavior through interactive processes between motivation, volition, emotion, attention, metacognition and action control systems. As Hannula (2006) points out, self-regulation should be seen to be much more than mere metacognition. For example, Malmivuori (2006) states that within self-system processes, emotions activate various self-regulatory processes at different levels of self-awareness, including self-reflection. She contrasts automatic affective regulation (low level of control) to active regulation of affective responses (high level of control).

-- Insert Figure 2 about here --

Gagné (2004) has recently developed a model of giftedness and talent that finally distinguish the two usually intertwined concepts: The Differentiated Model of Giftedness and Talent (DMGT) is presented in Figure 3. His present view of talent development is summarized with the acronym *C.GIPE*. He sees chance (C) in a predominant role as it includes both genetic and parental endowment that affect gifts (G) and intrapersonal catalysts (I). Chance represents the degree of control over talent emergence in a similar way that attributions of success and failure are classified within a three-dimensional system (origin, stability, degree of control) in attribution theory (Weiner, 1986).

-- Insert Figure 3 about here --

According to Gagné (2004), Gifts (G) are preceding intrapersonal catalysts (I), such as motivational constructs, in the *C.GIPE* acronym. The reason is drawn from existing research body that shows IQ scores 'explaining' on average five times or more achievement variance than

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measures of motivation. Intrapersonal catalysts (I) are placed before practice (P) component in the acronym, because practice is based on the existence of I components, such as motivation, and thus I causally precede P. Environmental influences (E) have been placed in the last position because E differences in 'normal' environments will not explain the difference between average and outstanding achievements. (Gagné, 2004.) In our study setting, the E factor has more important role, as all the participants have enrolled in special vocational skill development training program. In our case, the role of social agents (parents, teachers, coaches) is much more important than Gagné visualizes in his DMGT model.

As the role of natural abilities is stressed on Gagné's DMGT model, it is natural to use one of the most well-know categorization for individual giftedness, Gardner's (1983) Multiple Intelligence Theory (MI). MI theory was first introduced with seven dimensions: 1) Linguistic; 2) Logical-mathematical; 3) Musical; 4) Spatial; 5) Bodily-kinesthetic; 6) Interpersonal; 7) Intrapersonal intelligence. Later, he discussed about adding two or more dimensions to the model (Tirri & Nokelainen, 2008). Sternberg (1991) identifies Gardner's MI theory as a systems approach similar to his own triarchic theory. In this study, we wanted to investigate work skill areas that would require excellence in various MI theory areas.

Method

The first subsample consists of eight Finnish WSC 2005 (Helsinki, Finland) and 2007 (Shitsuoka, Japan) participants who have been successful in both national and international competitions. Success was defined as at least diploma level performance in international competition (top two percent achievement category) or gold medal in Finnish national competition. Six of the

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participants are males ($M_{age}=21$ years) and two are females ($M_{age}=20$ years). Further, all the participants have been qualified for the Finnish national WSC training team.

These WSC participants represent four skill categories, which are linked to the MI theory (Gardner, 1983) as follows: 1) IT/Software Applications (logical-mathematical); 2) Web Design (spatial, logical-mathematical); 3) Plumbing (bodily-kinesthetic, spatial); 4) Beauty Therapy (interpersonal, bodily-kinesthetic, spatial).

The second subsample consists of WSC participant's personal trainers, work life representatives and parents ($n = 22$). Our motivation for interviewing 'important individuals' was, firstly, to have multiple information sources for cross-validation purposes of the results, and secondly, to learn about their role on young experts talent development process according to Greenspan, Solomon and Gardner (2004).

Textual empirical data was collected from both subsamples in 2007 with a semi-structured interview. The interview was based on Greenspan, Solomon and Gardner (2004), concentrating on two major aspects: 1) Influence of important individuals (non-domain or domain specific individuals use of intrinsic and extrinsic motivation); 2) importance of intrinsic and extrinsic motivation in initial participation to the training, perseverance and mastery of the skill (Bloom, 1985).

The measurement model is described in Figure 4. The boxes that have a dotted borderline, represent qualitative methods (semi-structured interview) that operationalize both the influence of non-domain and domain specific individuals and trainee's intrinsic and extrinsic motivational levels. The boxes that have a squared borderline, represent quantitative methods (self-report questionnaire) that operationalize affective, conative and cognitive constructs in the model. Survey results are to be reported elsewhere.

-- Insert Figure 4 about here --

Results and Conclusions

RQ 1: What characteristics typify a successful WSC participant?

Interview material from all three sources (WSC participants and their personal trainers, work-life representatives and parents) suggested following 23 characteristics of a successful vocational expert (frequency in parenthesis): Calmness (16); Stress tolerance (10); Exactness (9); Competitiveness (8); Manual skills (5); Ability to concentrate (4); Perceptive skills (4); Interest towards work field (4); Determination (4); Ambition (2); Motivation (2); Social skills (2); Perseverance (2); Carefulness (2); Methodicalness (2); Time management skills (2); Interest towards work (2); Good nerves (2); Problem-solving skills (2); Extrovertness (2); Ability to learn new things fast (2); Will to succeed (2); Development potential (2).

When these items are connected to the theory of self-regulation, we get the following short list of the most important characteristics: *Self-reflection* (calmness, stress tolerance, good nerves); *Volition* (exactness, ability to concentrate, determination, perseverance, time management skills); *Cognitive skills* (manual skills, perceptive skills, problem solving skills, ability to learn new things fast, development potential); *External goal-orientation* (competitiveness, ambition, will to succeed); *Internal goal-orientation* (interest towards work or work field); *Social skills* (extrovertness).

Important role of self-reflection was theoretically expected, as it separates experts from workers (Day, Arthur & Gettman, 2001; Pillay, 1998; Ruohotie, 2004). Experts are usually quite sensitive of recognizing and handling their emotions. Further, these main characteristics are quite similar to findings from US Olympic Champions research (Gould, Dieffenbach & Moffett, 2001)

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and international study of Academic Olympians in Mathematics, Physics and Chemistry (Campbell, 1996; Heller & Lengfelder, 2000; Wu & Chen, 2001). These findings support Gagné's theory: Development process leading from natural abilities (gifts) to excellence in certain work field (talent) calls for

Eriksson states that in most fields one is able to become an expert with deliberate practice that might take ten years (Ericsson, Krampe & Tesch-Römer, 1993). These findings suggest that in order to excel, we really need more than pure practice. We need to have innate gifts *and* ability to keep things under control, that is, to remain calm and analytic even in the toughest places.

Social skills were mentioned only few times during the interviews. Their small role was an expected finding, as the training for the four work areas (IT/Software Applications, Web Design, Plumbing, Beauty Therapy) studied here was targeted only at individual competition tasks.

When we examine the results according to the MI theory, we see clearly that cognitive skills are located between the volitional and motivational factors. This finding supports Gagné's (2004) *C.GIPE* order of importance factors for talent development. Beauty therapists stressed the importance of manual skills together with social skills, as they were working directly with clients, Other experts, and their trainers and work-life representatives, mainly stressed cognitive processing capacity and manual skills.

Overall, these results are comforting for career and technical education providers, as they stress the importance of controllable attributions (e.g., volition and self-reflection) over uncontrollable ones (e.g., innate mathematical or spatial ability). However, it is clear that the high achieving vocational experts possess both self-regulatory (motivation, volition, self-reflection) and cognitive abilities.

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RQ 2: How the WSC participants' characteristics differ during training period, competitions and working life?

Interviews of WSC participants and their important individuals showed that volitional characteristics are considered the most important in all three skill development stages of the young experts. Also the importance of cognitive skills and self-reflection abilities were mentioned as an important aspects of successful skill development. Motivation was mentioned as the third important aspect for skill development in all three stages. This was an expected finding as, according to Zimmermann's (1998) model of self-regulation, motivation is a prerequisite for volition. However, we found no difference between the importance of internal and external goal-orientations. Once again, it should be remembered that our target group consisted of international competition trainees, and thus it is viable to think that the importance of external motivational issues was a bit overrepresented in their responses.

As the results showed an increasing role of social skills during the three skill development stages, investing on young students ethical and multicultural sensitivity skills becomes a promising future development target for career and technical education institutions.

RQ 3: What characteristics specify the WSC participants' initial interest towards the work field, perseverance in acquiring the vocational skill and mastery of the skill?

Results showed that institutions and trainers support are important throughout the three skill development stages. Encouraging teachers were the most important factor in institutional support, and this finding fully shows the importance of Gagné's (2004) theory's 'luck' component. It makes a big difference where young individuals study, as teachers are in a key role to acknowledge and capitalize their potential. Luck has even more to do with career and technical

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education studies, as training institutions are not yet clearly ‘benchmarked’ – usual case is that young person will enroll to institution that is closest to his/her neighborhood. WSC participants mentioned several times teachers who were not willing or able to listen to their opinions during studies, or were not open minded enough for new and innovative ways of doing work-related tasks.

Interviews showed that motivational factors were important in all skill development stages. More specifically, internal goal-orientation was more important at the beginning and in the end of developmental process than external goal-orientation. This finding makes sense, as it is relevant to assume that thinking about future success or rewards is most needed during the skill acquisition phase. Important role of motivation in this study is an interesting finding as, according to Gagné (2004), international research has not been successful showing causal relationship between motivational aspects and actual task performance. On the other hand, our results clearly show that importance of both motivational aspects decrease towards the mastery level.

We found that future work possibilities played an important role in the mastery level. Success in competitions was reported to be directly related to future work offerings. Further, role of social skills stayed quite small and stable throughout the skill development process. Like in the previous research question, this finding might be unique to this study setting, as the participants were trainees for individual competition tasks.

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References

- Bloom, B. S. (Ed.) (1985). *Developing talent in young people*. New York: Ballantine Books.
- Boekaerts, M., & Niemivirta, M. (2000). Self-regulation in learning: finding a balance between learning and ego-protective goals. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-regulation* (pp. 417-450). San Diego, CA: Academic Press.
- Campbell, J. R. (1996). Developing cross-national instruments: Using cross-national methods and procedures. *International Journal of Educational Research*, 25(6), 485-496.
- Day, E. A., Arthur, W., & Gettman, D. (2001). Knowledge structures and the acquisition of a complex skill. *Journal of Applied Psychology*, 86, 1022 - 1033.
- Driscoll, M. (2005). *Psychology of learning for instruction*. Third edition. Toronto, ON: Allyn & Bacon.
- Ellström, P.-E. (1994). *Kompetens, lärande och utbildning i arbetslivet. Problem, begrepp och teoretiska perspektiv*. [Skills, learning, and education in working life. Problems, concepts, and theoretical perspectives]. Stockholm: Publica.
- Ellström, P.-E. (2001). The many meanings of occupational competence and qualification. In W. J. Nijhof & J. N. Streumer (Eds.), *Key Qualifications in Work and Education* (pp. 39-50). Dordrecht: Kluwer Academic Publishers.
- Ericsson, K. A., Krampe, R., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, 100, 363-406.
- Gagné, F. (2004). Transforming gifts into talents: the DMGT as a developmental theory. *High Ability Studies*, 15(2), 119-147.
- Gardner, H. (1983). *Frames of mind*. New York: Basic Books.
- Gould, D., Dieffenbach, K., & Moffett, A. (2001). *Psychological talent in Olympic medal winning athletes. US Olympic Committee Sport Science and Technology Final Grant Report*. Colorado Springs, CO.
- Greenspan, D. A., Solomon, B., & Gardner, H. (2004). The development of talent in different domains. In L. V. Shavinina & M. Ferrari (Eds.), *Beyond knowledge* (pp.119-135). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Nokelainen, P., & Ruohotie, P. (2009, April). Characteristics that Typify Successful World Skills Competition Participants. Paper presented at American Educational Research Association annual meeting, San Diego, US.

Hannula, M. S. (2006). Motivation in mathematics: Goals reflected in Emotions. *Educational Studies in Mathematics*, 63(2), 165-178.

Heider, F. (1958). *The psychology of interpersonal relationships*. New York: Wiley.

Heller, K., & Lengfelder, A. (2000, April). *German Olympiad study on mathematics, physics and chemistry*. Paper presented at the annual meeting of American Educational Research Association, New Orleans, USA.

Malmivuori, M.-L. (2006). Affect and Self-Regulation. *Educational Studies in Mathematics*, 63(2), 149-164.

Nokelainen, P. (2008). *Modeling of Professional Growth and Learning: Bayesian approach*. Acta Universitatis Tampereensis 1317. Tampere, Finland: Tampere University Press.

Nokelainen, P., Tirri, K., & Merenti-Välimäki, H.-L. (2007). The Influence of Self-attributions and Parental Attitude to the Development of Mathematical Talent. *Gifted Child Quarterly*, 51(1), 64-81.

Pillay, H. (1998). Adult learning in a workplace context. In P. Sutherland (Ed.), *Adult Learning: a Reader* (pp. 122-136). London: Kogan Page.

Ruohotie, P. (2002). Motivation and self-regulation in learning. In H. Niemi & P. Ruohotie (Eds.), *Theoretical Understandings for Learning in the Virtual University* (pp. 37-72). Hämeenlinna: RCVE.

Ruohotie, P. (2004). Self-regulatory Abilities in Professional Learning. In J. R. Campbell, K. Tirri, P. Ruohotie, & H. Walberg (Eds.), *Cross-cultural Research: Basic Issues, Dilemmas, and Strategies* (pp. 159-184). Hämeenlinna, Finland: RCVE.

Ruohotie, P., & Nokelainen, P. (2000). Beyond the Growth-oriented Atmosphere. In B. Beairsto & P. Ruohotie (Eds.), *Empowering Teachers as Lifelong Learners* (pp. 147-167). Hämeenlinna: RCVE.

Schunk, D. H., & Ertmer, P. A. (2000). Self-regulation and academic learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of Self-Regulation* (pp. 631-650). San Diego, CA: Academic Press.

Sternberg, R. (1985). *Beyond IQ: A triarchic theory of human intelligence*. New York: Cambridge University Press.

Nokelainen, P., & Ruohotie, P. (2009, April). Characteristics that Typify Successful World Skills Competition Participants. Paper presented at American Educational Research Association annual meeting, San Diego, US.

Tirri, K., & Nokelainen, P. (2008). Identification of multiple intelligences with the Multiple Intelligence Profiling Questionnaire III. *Psychology Science Quarterly*, 50(2), 206-221.

Trishman, S., Jap, E., & Perkins, D. N. (1993). Teaching thinking disposition: From transmission to enculturation. *Theory into Practice*, 32, 147-53.

Weiner, B. (1986). *An attributional theory of motivation and emotion*. New York: Springer.

Williams, R. S. (2002). *Managing Employee Performance*. London: Thomson Learning.

Wu, W., & Chen, J. (2001). A follow-up study of Taiwan physics and chemistry Olympians: The role of environmental influences in talent development. *Gifted and Talented International*, 16(1), 16-26.

Zimmerman, B. J. (1998). Developing self-fulfilling cycles of academic regulation: An analysis of exemplary instructional models. In D. H. Schunk & B. J. Zimmerman (Eds.), *Self-Regulated Learning: From Teaching to Self-Reflective Practice* (pp. 1-19). New York: The Guilford Press.

Zimmerman, B. J. (2000). Attaining self-regulation. A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13-39). San Diego: Academic Press.

Zimmerman, B. J. (2002). Achieving academic excellence: A self-regulatory perspective. In M. Ferrari (Ed.), *The Pursuit of Excellence Through Excellence* (pp. 85-112). Mahwah, NJ: Lawrence Erlbaum Associates.

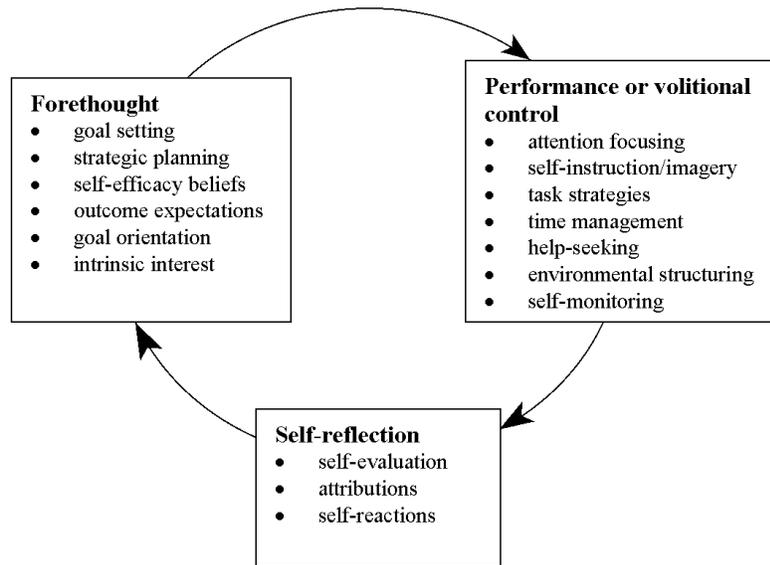


Figure 1. Cyclical Phases and Sub processes of Self-regulation (Ruohotie, 2002, p. 40; adapted from Zimmerman, 1998, 2002)

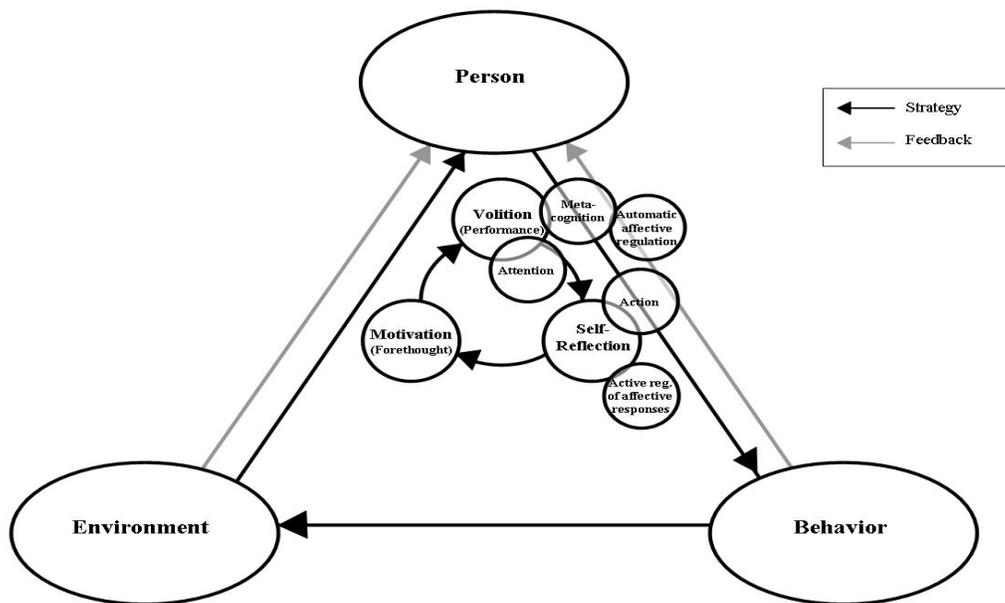


Figure 2. Self-regulation as a System Concept Managing Leadership Competence through Interactive Processes between Different Control Systems (Adapted from Zimmerman, 2000, p. 15-16)

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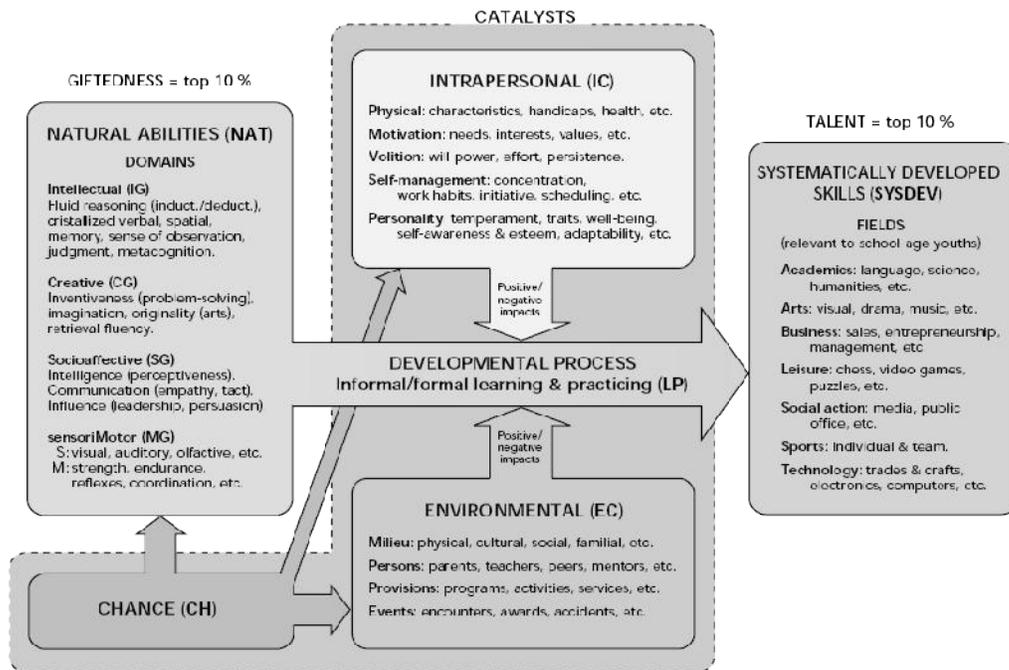


Figure 3. The Differentiated Model of Giftedness and Talent (Gagné, 2004)

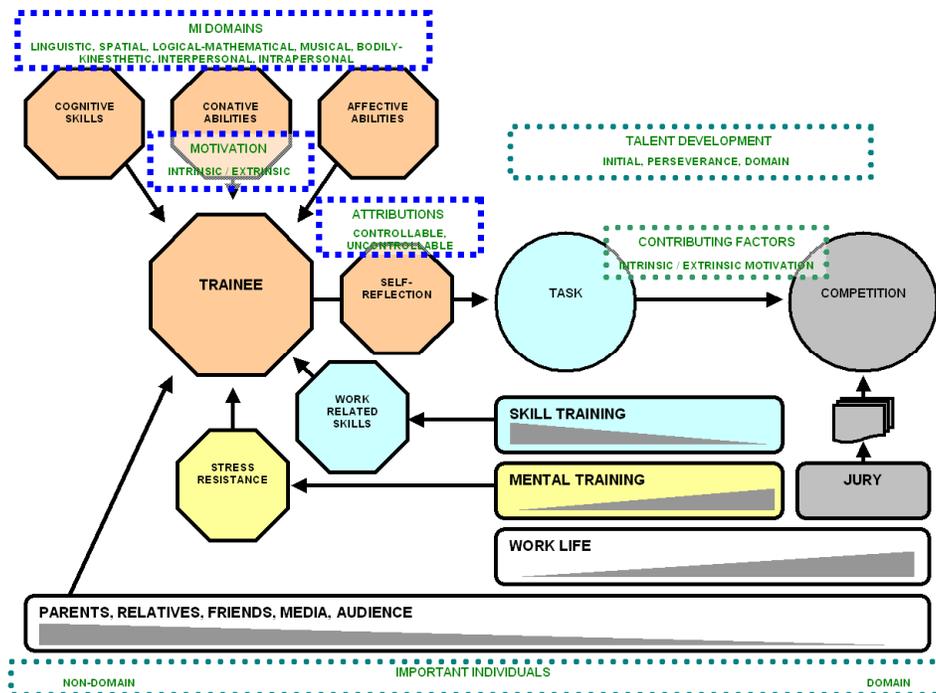


Figure 4. Measurement Model of the Study