Dynamic testing and excellence: unfolding potential

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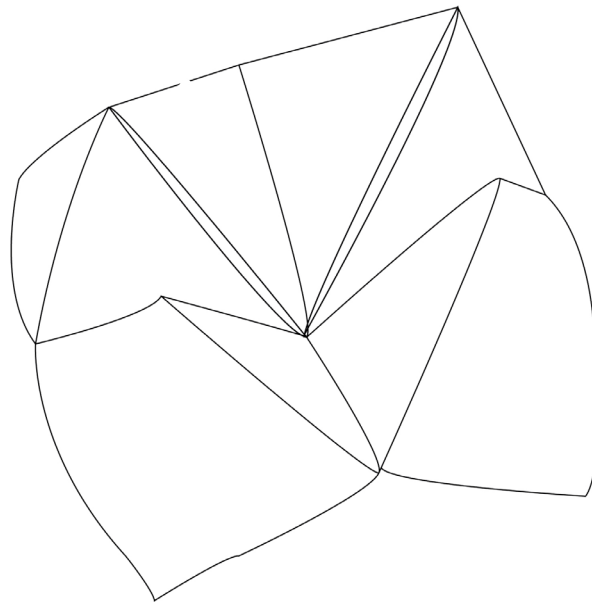
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CHAPTER 6

General Discussion

The field of research into dynamic testing is dominated by studies looking into the cognitive abilities of special populations, such as children from diverse ethnic backgrounds, with learning and intellectual disabilities while studies examining the cognitive abilities of gifted children are far more scarce. In this thesis, dynamic testing principles were applied to examine analogy problem-solving of gifted and average-ability children, in order to detect potential differences between these two groups of children.

Potential differences in analogy problem-solving were examined between gifted and average-ability children in relation to age (Chapter 2), instructional needs (Chapters 2 and 4), and transfer of learned skills by means of an analogy construction task (Chapter 5). In addition, within these two groups of children, two aspects of executive functioning, metacognition and cognitive flexibility (Chapter 4), were investigated as aspects that might facilitate the development of expertise, as posited by Sternberg's (1999, 2001; Sternberg, Jarvin, & Grigorenko, 2011) Developing Expertise Model. Test anxiety was examined with the objective to identify an aspect that potentially prevents the unfolding of the development of expertise (Chapter 3).

In this chapter, a summary of the most important findings of the studies in this thesis is provided. These findings will first be discussed in terms of their theoretical and practical considerations in relation to giftedness. Then, limitations of the studies in this thesis will be discussed. Finally, some implications for educational practice, and future research will be considered.

Summary of findings

The main aim of the study described in Chapter 2 was to identify potential differences between 5-8 year old gifted and average-ability children in relation to their potential for learning and need for instruction. It was found, in general, that dynamic testing and unguided practice opportunities both led to improvement, but that dynamic testing led to more advanced progression in accuracy. In addition, gifted children outperformed their average-ability peers in relation to accuracy in analogy problem-solving at each stage of the dynamic test, but, contrary to the expectations, showed equivalent progression paths, benefitted to similar degrees of training, and revealed similar degrees of instructional needs, both with regard to the amount, and the type of prompts they had received. Moreover, in line with the hypotheses, younger children showed less progression in accuracy, and needed more prompts than their older peers.

Chapter 3 focused on differences between 7-8 year old gifted and average-ability children with regard to their progression in analogy problem-solving after unguided practice opportunities or a dynamic training, and the

potential differential impact of text anxiety on progression. The results of this study again revealed that dynamic testing led to more advanced progression in accuracy than unguided practice. Compared with their average-ability peers, gifted children demonstrated higher mean scores in relation to initial analogy problem-solving accuracy, and accuracy after unguided practice or training, but showed equivalent progression paths. Test anxiety was found to influence the children's rate of change across all test sessions, and their improvement in accuracy after dynamic training with children with higher levels of test anxiety benefitting more from training. Counter to the expectations, gifted and average-ability children did not differ significantly in the extent to which test anxiety was associated with their progression in solving analogies.

In Chapter 4, it was investigated whether two aspects of executive functioning, cognitive flexibility and metacognition, would be related to progression, after unguided practice or a dynamic training, of the number of correct transformations in analogy problem-solving of 7-8 year old gifted and average-ability children. Potential differences in instructional needs of gifted and average-ability children were also examined. The results revealed that dynamic testing led to more progression in the number of correct transformations than unguided practice opportunities. Gifted children demonstrated higher mean scores in relation to the initial number of correct transformations when solving analogies, and after unguided practice or training, but did not demonstrate steeper progression paths than their average-ability peers.

In contrast to the expectations, cognitive flexibility and metacognition did not influence children's progression over time, and the progression paths of gifted and average-ability children with higher levels of cognitive flexibility and metacognition were equivalent. Cognitive flexibility was also not found to be related to training benefits, but children with lower levels of metacognition, as estimated by their teachers, demonstrated more improvement in the number of correct transformations after the dynamic training than their peers with higher levels of metacognition. Finally, gifted and average-ability children required similar amounts of prompts during the dynamic training.

The aims of Chapter 5 were two-fold. The first aim concerned children's potential for learning, and it was investigated whether 9-10 year old gifted and average-ability children would show differential progression of accuracy in analogy problem-solving after unguided practice or a dynamic training. Secondly, it was examined whether gifted and average-ability children would demonstrate significant differences in transfer of solving analogies to an analogy construction task (focusing on both correctly constructed analogies and the difficulty level

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of the analogy items), whether training would facilitate transfer, and whether children's analogy problem-solving accuracy scores could predict accurately constructed analogies, and the difficulty level. The results indicated that dynamic testing led to more improvement in accuracy than unguided practice, and that unguided practice and dynamic testing led to an equivalent decrease in solving-time. Gifted and average-ability children differed in accuracy scores at each test session, with an advantage for those who were gifted, but not in completion time. Moreover, gifted and average-ability children showed equivalent progression paths in accuracy and solving-time after unguided practice opportunities or training.

With regard to transfer, it was found that training could not predict the number of accurately constructed analogies, nor the difficulty level of the analogies constructed by the children. No differences were found for gifted and average-ability children between the number of accurately constructed analogies, nor the difficulty level of the items constructed by them. However, when comparing the children who were trained with those who had received practice opportunities only, it became clear that there were more trained children who had constructed items of a high difficulty level, and less trained children who had constructed items of a low difficulty level than children who had practiced analogy problem-solving only.

Theoretical and practical considerations

Dynamic versus static testing

The studies presented here supported the assertion of several authors that dynamic testing unveils a more insightful view of children's ability to learn than static testing (e.g., Elliott, 2003; Elliott et al., 2010; Resing, 2013; Robinson-Zañartu & Carlson, 2013; Sternberg & Grigorenko, 2002). Children were found to improve more in accuracy of analogy problem-solving (Chapters 2, 3, and 5), as well as in the number of correct transformations they applied when solving analogies (Chapter 4), but not in the time it took them to solve the test items (Chapter 5). Moreover, dynamic testing revealed significant individual differences in children's (progression in) test scores (Chapters 2, 3, 4, 5), instructional needs (Chapters 2, and 4), and transfer success, as measured by the number of correctly constructed analogies and effectiveness, as measured by the difficulty level of the items constructed (Chapter 5). These findings, however, seem irrespective of ability category (Chapters 2, 3, 4, 5), and age (Chapter 2). It was repeatedly revealed that after training both gifted and average-ability children demonstrated (equivalent) progression in analogy problem-solving. The findings that the gifted children showed progression after a training further suggests that using dynamic

testing to assess the cognitive abilities of high potential children is useful, and, more importantly, leads to a more insightful view of their capabilities than using a static test only.

All studies in this thesis had a (pre-test)-pre-test-training-post-test design, with graduated prompting techniques. As prompts were administered hierarchically, i.e. ranging from metacognitive to cognitive prompts to modelling, that became more specific whenever a new prompt was provided, these procedures allowed for measuring the different degrees of help individual children needed in learning a new task (Resing & Elliott, 2011). In this sense, this training procedure provided information on children's instructional needs (Resing, 2013).

Taking into account previous findings, suggesting gifted children to be more responsive to feedback (Kanevsky, 1994), and have an advantage in self-regulation (Calero, García-Martín, Jiménez, Kazén, & Araque, 2007; Zimmerman, 1989), these children were expected, in terms of the quantity of feedback, to need less prompts, and, in terms of the quality of feedback, less specific help. However, in Chapter 2 (5 to 8 year olds), and in Chapter 4 (7 and 8 year olds), it was consistently found that gifted children and their average-ability peers had equivalent needs for instructions, both with regard to the number of prompts and the type of prompts and qualitatively. Nevertheless, significant individual differences were found in both the amount as well as in the type of prompts children needed during training, regardless of whether they were identified as gifted or average-ability.

Developing Expertise Model

As demonstrated by the findings of the studies that are part of this thesis, it seems that abilities can be considered as entities that are not stable, or fixed, but dynamic, which can be developed further given the right circumstances (e.g., Sternberg & Grigorenko, 2002). In the light of Sternberg's (1999, 2001; Sternberg et al., 2011) Developing Expertise Model, gifted children's potential for learning could, in fact, also be considered as developing expertise. According to Sternberg (2001), individuals are gifted if they have an unusual ability to "advance from abilities that are ready to be developed to those that are developed" (p. 2). Sternberg further states that children are continuously engaged in a process of developing expertise when learning new knowledge or skills. According to him, gifted children are those who exhibit extraordinary potential in one or several of the skills involved in developing expertise.

The present thesis examined several aspects that, according to Sternberg (1999; 2001; Sternberg et al., 2011), play a pivotal role in learning, and, ultimately, the development of expertise; two aspects of executive functioning, metacognition

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and cognitive flexibility, considered part of the Developing Expertise Model, were examined. It was also studied whether another factor in his model, test anxiety, might prevent the unfolding of the development of expertise. Finally, transfer was also investigated within this framework.

Executive functioning. The provisional finding that children with lower levels of metacognition, as estimated by their teachers, progressed more after training, and thus, benefitted more from training than their peers with higher levels of metacognition tentatively suggests that children in this latter group have developed more expertise independently than those with lower levels, supporting to some degree Sternberg's model. It seems, further, that the dynamic training, to a certain extent, compensated children who had lower levels of metacognition, underlining once more the importance of testing children dynamically. Although a small effect, these findings seem to support Sternberg's (1999; 2001; Sternberg et al., 2011) assertion that metacognitive skills provide individuals with understanding and control of their cognition, which facilitates learning. Although it was expected that children with different levels of metacognition would show differential progression in analogy problem-solving after repeated practice and repeated practice in combination with a dynamic training, with an advantage for gifted children, this was not supported by the data. This finding was unexpected in the light of the fact that gifted children are often credited for having excellent metacognition (e.g., Shore, 2000), but could be explained by Sternberg's (2001, Sternberg et al., 2011) assertion that metacognitive skills are often domain-specific, and the teacher rating scale used to assess children's metacognition most probably provides a general estimation of children's metacognition, as demonstrated in the classroom. Moreover, in a recent study by Veenman, Bavelaar, De Wolf, and Van Haaren (2014) it was found that gifted learners are just as likely as their non-gifted peers to suffer from metacognitive deficiencies. According to these authors, gifted learners might rely primarily on their intelligence when performing tasks, as a result of which they do not feel the need to develop their metacognitive skills further.

A second aspect of executive functioning examined in Chapter 4 was cognitive flexibility, noted for its importance in the learning process (e.g., Diamond, 2013). Cognitive flexibility is considered by some researchers to be amongst the key components of cognitive adaptability, and is in that way critical to adaptive expertise, and problem solving (e.g., Haynie & Shephard, 2009; Moncarz, 2011). It is also assumed to be a component of creative thinking, one of the three sets of thinking skills identified by Sternberg (1999; 2001; Sternberg et al., 2011). Cognitive flexibility was measured in this study by means of a performance-based task. In

this study, no support could be found for the hypotheses that cognitive flexibility would be related to the development of

expertise, or training benefits. This could mean that cognitive flexibility does not play such an important role in analogy problem-solving, although it could also be related to the manner in which cognitive flexibility was measured. This is discussed in more depth under methodological considerations.

Test anxiety. Whereas the skills that are part of the Developing Expertise Model facilitate learning, other factors might, to some extent, hinder the learning of new knowledge and skills, and in that way, prevent a child from unfolding the further development of expertise. One of these aspects is test anxiety, examined in Chapter 3.

The findings of this study suggest that test anxiety can indeed have a negative impact on developing expertise, and that providing children with training in a certain skill might alleviate test anxiety levels (e.g., Bethge, Carlson, & Wiedl, 1982). In this respect, dynamic testing seems to have less bias towards children with test anxiety than static testing (cf. Meijer, 1996, 2001). Although several authors have proposed that gifted children may experience less (negative effects of) test anxiety (e.g., Zeidner & Shani-Zinovich, 2011), the results of Chapter 3 indicate that gifted and average-ability children experience similar levels of test anxiety, and that both groups of children show equivalent effects of test anxiety on their progression in analogy problem-solving.

Transfer. The ability to generalise learning to other contexts – known as transfer – was studied in Chapter 5. The findings of Chapter 5 lend support to the assumption that expertise in a skill improves the chances of successful transfer. In addition, children who achieved higher analogy accuracy scores at the post-test were found to demonstrate higher rates of accurately constructed analogy items (transfer success), as well as items of a higher difficulty level (transfer effectiveness), supporting Siegler's (2006) assertion that in order to transfer knowledge or skills successfully, mastery of the task at hand is required. In particular, this finding also supports Barnett & Ceci (2002)'s statement that deep transfer can only be achieved if an individual has reached deep rather than surface understanding of the task to be transferred (Barnett & Ceci, 2002). Support was also lent to the notion that transfer ability can be indicative of children's differential potential for learning, as significant individual differences were found between children, regardless of whether they were identified as gifted or average-ability (e.g., Bosma & Resing, 2006; Campione et al., 1985; Elliott et al., 2010).

Clerc, Miller, and Cosnefroy (2014) provided some rationale for the unexpected findings that training could not predict transfer accuracy or difficulty

level. These authors postulated that self-regulation can interfere with transfer, making children with low or high self-regulation at risk for transfer difficulty. A child's metacognitive knowledge in relation to transferring a skill might be ahead of the child's actual ability to apply the skill. It was suggested in Chapter 5 that perhaps some of the gifted children who were trained were unwilling to apply the strategies they had learned in the training, as they might have felt their ability to apply what they had learned in training was not yet at the same level of their metacognitive knowledge in regards to analogy problem-solving.

Limitations

Solving analogy items

In this thesis, geometric analogy items were used to examine children's changes over time in analogy problem-solving. Accuracy scores, number of correct transformations, and solving time were used as indicators of children's analogy problem-solving skills. Potential bottom and ceiling effects were identified amongst the youngest and oldest study participants in Chapters 2, 3, and 4 (5-8 year olds). In order to avoid a ceiling effect amongst the 9 and 10 year old participants (Chapter 5), the difficulty level of the test sessions was increased by using items that contained more transformations only, and increasing the number of elements and transformations in certain items. Inspection of the mean scores as well as individual scores of children revealed larger mean differences between the two ability categories than in the studies with younger participants (Chapters 2, 3, 4), with none of the children reaching the test ceiling. The scores of the gifted and average-ability groups of children, however, demonstrated the same pattern as in the studies described in Chapters 2, 3, and 4 (see for example Figure 2 in Chapter 2), indicating that this pattern is fairly robust. A ceiling effect amongst the 7 and 8 year old children can, however, not be discounted as yet, and needs further examination. Future dynamic testing studies should be conducted amongst the same groups of children utilising more difficult tasks in order to confirm this.

Only children's quantitative analogy problem-solving performance was considered in the current thesis. In future studies, it would therefore be useful to investigate in more detail children's strategic considerations when solving these items. Studies amongst older participants suggested that novices and experts use different strategies when solving analogy problems (e.g., Ozkan & Dogan, 2013), and, utilising the framework provided by Sternberg's Developing Expertise Model, it would be interesting to investigate whether such differences are already apparent amongst primary school children, especially when considering individual differences demonstrated by children when solving analogies (e.g.,

Resing, 2013).

In order to do so, it might be worthwhile to computerise the tests used in this thesis. Earlier research has indicated that assessment mode, paper-and-pencil versus digital test version, did not influence children's strategy use when solving analogy items (Stevenson, Touw, & Resing, 2011). These authors found that administering the test of analogical reasoning digitally instead of on paper took significantly less time to administer and analyse, and allowed for registering additional test information. Computerising the analogy items could further enhance scoring uniformity in future studies.

The influence of executive functioning on progression in analogy problem-solving

The potential influence of executive functioning on analogy problem-solving was examined in Chapter 4. Since, as posited in the introduction, measuring the executive functioning of (young) children is considered challenging, both a performance-based task and a rating scale were used as executive functioning measures, in accordance with recommendations in the literature (e.g., Toplak, West, & Stanovich, 2013). As described above, the findings of this study could not fully support expectations based on previous findings. Potential reasons for this include the developmental nature of executive functions, and the nature of the tasks used in the study.

While it is known that executive functioning develops in childhood (Diamond, 2013), the exact nature of its development and underlying processes are not yet fully understood (Deák, 2004; Veenman, Van Hout-Wolters, & Afflerbach, 2006; Miyake & Friedman, 2012). What is clear, however, is that these issues make it complicated to measure executive functioning accurately, in particular in the light of the assumption that they are higher-order functions, which require assessment that involves complex paradigms and measures (Deák, 2004; Veenman et al., 2006; Miyake & Friedman, 2012).

It should further be noted that the performance-based task measuring cognitive flexibility, the BCST-64, is a single measurement, static test. Perhaps, utilising a dynamic task measuring cognitive flexibility, such as the dynamic Wisconsin Card Sorting Task (e.g., Boosman, Visser-Meily, Ownsworth, Winkens, & Van Heugten, 2014) in future studies would lead to different results. Likewise, metacognition was measured by means of a teacher rating scale. Research suggests that rating instruments do not always fully capture children's executive functioning (e.g., Sadeh, Burns, & Sullivan, 2012). Of course, individual differences between teachers when completing the rating form should also be taken into consideration. Likewise, as posited by Sternberg (2001; Sternberg et al., 2011), metacognitive skills are predominantly domain-specific, and a teacher rating

scale provides an estimation of metacognition as demonstrated by the child in general in the classroom.

In sum, more research is needed to provide more information on the exact nature of executive functioning, its development, and underlying processes, as well as in relation to the instruments that can reliably capture different aspects and (sub)components of executive functions.

The influence of test anxiety on progression in analogy problem-solving

The influence of test anxiety on analogy problem-solving was examined in Chapter 3. Test anxiety was measured by means of the CTAS, a self-report questionnaire developed for children in grades 1-6 (Wren & Benson, 2004). Test anxiety was measured only once in this study, and as a result, previous findings that dynamic testing might reduce test anxiety (e.g., Bethge et al., 1982) could not be supported. While self-report measures are widely in the assessment of test anxiety (e.g., Wren & Benson, 2004), there are, however, some limitations associated with the use of self-report questionnaires, especially for young children, which ought to be mentioned. Social desirability (Galla, Plummer, White, Meketon, D'Mello et al., 2014), and memory distortions (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) can affect the outcomes of a self-report questionnaire. Likewise, due to the fact that reading and language comprehension, memory, attention, abstract thinking and self-reflection are still developing significantly amongst young children, some authors question the use of self-report to assess the mental health of young children (e.g., Fallon & Schwab-Stone, 1994; Kuijpers, Otten, Vermulst, & Engels, 2014).

Therefore, in future studies investigating more closely the relationship between dynamic testing, and test anxiety scores, test anxiety could be measured before and after the dynamic test. It might be useful to combine self-report, with informant-report measures of test anxiety to obtain a more insightful, and objective view of children's test anxiety levels.

Characteristics of gifted children

In the current thesis, only cognitive aspects of the characteristics of gifted children were examined. Children were identified as gifted on the basis of parents' and teachers' nominations only (Chapter 2), or a combination of these with a percentile score of at least 90 of the Raven Standard Progressive Matrices Test, as a measure of their intellectual ability (Raven, 1981; Chapters 2, 4, and 5). The findings of this thesis suggest that, regardless of the identification process used, the gifted children showed similar patterns as the average-ability children, for example in relation to their progression in analogy problem-solving, and instructional needs. Although the Raven is considered a robust measure of

general intelligence (e.g., Jensen, 1998), of course, there are several other factors that are assumed important in the cognitive and intellectual functioning of these children, such as task commitment or creativity (e.g., Renzulli, 2005; Renzulli & D'Souza, 2014).

Sternberg's Developing Expertise Model, for instance, also takes into account non-cognitive factors (e.g., Sternberg, 2001; Sternberg et al., 2011). The factors described in this model could be used in future studies when examining more closely both cognitive and non-cognitive factors that are associated with learning, and the development of expertise. The question as to how gifted children managed to achieve significantly higher performance scores than their average-ability peers has not been answered by the studies in this thesis. In future studies, it is therefore recommended to look more closely at the aspects of this model, and investigate to what extent these children demonstrate differences in the functioning of these elements, and in the direct and indirect relationships between these factors.

Practical implications

The notion that (static) cognitive test results do not always provide sufficient information for educational or pedagogical interventions has recently received more attention in research and practice (e.g., Compton, Fuchs, Fuchs, Lambert, & Hamlett, 2012; Fletcher, Stuebing, Barth, Denton, Cirino et al., 2011). This notion seems especially relevant in the light of recent changes in education policy leading to the implementation of inclusive education. Dynamic testing outcomes have been advocated as measures that reveal more insight into the processes and cognitive aspects that play a role in how children learn (e.g., Sternberg & Grigorenko, 2002; Resing, 2013), and in that sense, provide insightful information that can, for instance, serve as a starting point for the implementation of didactic interventions, and individual action plans (e.g., Jeltova, Birney, Fredine, Jarvin, Sternberg et al., 2007; Resing, 2013). The results found as part of this thesis resulted in a number of implications and recommendations for educational practice and future research, which are discussed in this section.

Assessment of children's cognitive abilities

The findings of the current thesis have consistently shown that testing children dynamically rather than statically results in a more accurate view of their cognitive potential. It was found that some children do not always show their full potential on a static test, and, thus, potentially underperform on a static test, which this thesis has suggested can be the result of deficits in metacognition, or test anxiety. Therefore, when children's cognitive abilities are tested for the purposes of decisions regarding the school level best suited for a child, it is recommended

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that dynamic tests are administered, especially when metacognitive deficits or test anxiety are suspected. Administering static tests might lead to underestimation of children's abilities, which, ultimately, could result in the loss of cognitive potential. Considering that the Dutch government aim to remain in the top five of knowledge-driven economies (Ministerie van Economische Zaken [Dutch Ministry of Economic Affairs], 2013), tapping into the potential of today's children is crucial. This recommendation seems especially valid for high-ability children, as today's high potential children are the scientists, politicians, directors, and entrepreneurs of the future.

Identification of gifted children

The previous recommendation also applies to the identification of giftedness. As discussed in Chapter 1, if a child is believed to be gifted, and in need of education that better suits his or her needs, it is common practice to test the cognitive abilities of these children statically. The outcomes of such testing procedures are then used to determine whether this particular child is eligible for participation in educational settings for the gifted and talented (e.g., Lohman & Gambrell, 2012). If, however, a strict IQ cut-off score of, for instance, 130, is used, a child that scores under 130, for example 129 or 128, might not be eligible for this type of education. This child is, however, potentially just as well suited for this type of education as a child scoring at or above the 130 IQ cut-off score. Therefore, it is recommended that, instead of focusing only on static test outcomes when considering whether a child is eligible for gifted education, it should also be considered how or why a child achieved a certain score, taking into account, for instance, the elements of the Developing Expertise Model. Moreover, such decisions should also be based on various information about a child's learning capabilities, instead of just one measure, including measures of potential for learning, and instructional needs. It seems valuable to make educational professionals more aware of the fact that gifted children do not always live up to their potential when they are being tested, especially regarding static tests, and that these children also learn within the zone of proximal development.

In conclusion, the findings discussed in this thesis question the idea that giftedness is a static entity, and that one simply "is" or "is not" gifted (Pfeiffer, 2011). It might be more worthwhile to think of giftedness as a more dimensional rather than a dichotomous concept (see e.g., Pfeiffer, 2011; Sternberg et al., 2011). It seems more valid to view giftedness not as a stable category that one simply "has" or "has not", but as an innate ability that is developmental and dimensional in nature, assuming there are different "levels" of giftedness (e.g., Sternberg, 2001; Sternberg et al., 2011) that, depending on several factors and circumstances

may or may not be developed fully within an individual. These conclusions are in line with Subotnik et al. (2012), who acknowledge the developmental nature of giftedness, stating that in the beginning stages, giftedness might manifest as potential, and in later stages as achievement, and, fully developed, as eminence.

Tailoring to the educational needs of gifted children

The results of the current thesis underline that gifted children, just like non-gifted children, demonstrate significant individual differences when learning new skills, for instance in relation to their progression in learning, instructional needs, transfer ability, (influence on learning progression of) executive functioning, and levels of test anxiety. It is therefore crucial to ensure that gifted education incorporates possibilities for catering to individual learners' needs. Teachers and teacher educators should be made aware that gifted children cannot all be tarred with the same brush, and some of these children might even need extra attention or help to unfold their potential.

In practice, education for the gifted is often based on enrichment and/or acceleration principles (Gubbels, Segers, & Verhoeven, 2014; Hoogeveen, Van Hell, & Verhoeven, 2011; Schiever & Maker, 2003). Whereas these principles have proven to be effective for many gifted children, the results of this thesis suggest that a "one size fits all" approach does not benefit all gifted children. The findings of this thesis indicate that the instructional needs of gifted children are comparable to their average-ability peers in relation to the quantity and the type of instructions they need. This suggests, ultimately, that differentiation techniques in relation to instructional practice are necessary in gifted education, just like in other forms of education, for example by means of adaptive instruction (e.g., Heller, 1999).

Therefore, we advocate that education for the gifted, and other children alike, should be constructed on principles from the Developing Expertise Model (Sternberg, 1999, 2001; Sternberg et al., 2011), and the talent development framework. This latter framework emphasises "the deliberate cultivation of psychosocial skills supportive of high achievement, persistence, and creativity rather than leaving these to chance" (Olszewski-Kubilius & Thomson, 2015, p.54). According to these authors, the framework of talent development puts more emphasis on developing talent and potential, and, in that respect, provides more opportunities for tailoring to the needs of a more diverse range of children who are identified as gifted, including children with culturally and linguistically diverse backgrounds.

Future research

It was postulated in this thesis, and by other authors (e.g., Calero, García-Martín, & Robles, 2011; Kanevsky, 2000; Sternberg, 2001), that, just like other

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children, learning of gifted children occurs within the zone of proximal development. As revealed by the studies in this dissertation, gifted children's zone of proximal development is more advanced than that of their average-ability peers. These findings further seem to suggest that gifted children's learning, just like other children, can be characterised by the principles of the overlapping waves model posited by Siegler (1996). Three assumptions underpin this model: at any given time children have access to a variety of strategies that they can utilise to solve problems; they vary in which strategies they choose, suggesting that the strategies compete with each other; and the cognitive development of children is characterised by changes, occurring gradually, in relation to the frequency of utilisation of these strategies, as well as in the introduction of more advanced strategies, with the least effective strategies gradually disappearing. In line with this reasoning, it is recommended that future research focuses on the problem-solving processes of these children, investigating to what extent gifted children differ from average-ability children in their strategic choices. If conducted within the dynamic testing framework, such studies could shed more light on whether tapping into these children's zone of proximal development reveals differences in strategic functioning of these two groups of children.