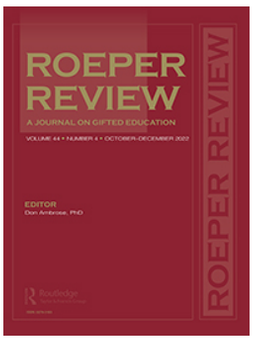

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Back to the Drawing Board: A Descriptive Study on Potential Indicators of Giftedness in Human Figure Drawings of Children Aged 4 to 6 Years

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ABSTRACT

This study described exceptional items in human figure drawings (HFDs) which have been discussed as possible expressions of intellectual giftedness. The aim was to serve as a first step in the development of a screener for HFDs that can be used as part of the identification process of gifted children. We examined the frequency of occurrence of 158 items in HFDs of 206 children aged 4 to 6 years (17 potentially gifted). Fine details and additions to the human figure turned out to be exceptional, especially in drawings of 4-year-olds. Several exceptional items were drawn more frequently or exclusively by potentially gifted children. Descriptively, exceptionality in drawings of potentially gifted children was most visible in HFDs of 4-year-olds, and tended to become less visible with age. Further research with larger samples is required to draw solid conclusions about HFDs of gifted children.

KEYWORDS

giftedness; human figure drawings; identification; talent; young children

Gifted children are not always identified by (educational) professionals. In this paper, by "gifted children" we mean "children who give evidence of high performance capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities," as outlined in the revised Elementary and Secondary Education Act of 2002 (in Ambrose & Machek, 2015, p. 121). Proper identification of intellectually gifted children and their needs can be difficult, since their potential is not always reflected in academic achievement (Emerick, 1992; Siegle & McCoach, 2018). When these children and their needs are not properly identified, their need for a more challenging and creative curriculum is not always met (e.g., Subotnik et al., 2011), and their talents consequently may not develop, leading them to underachieve. A new way of screening children for the sake of developing their talents at an early age, as recommended by Ziegler and Stoeger (2012), is the focus of the present study.

Shortly after the Terman (1926) studies, "scholars started to reflect on the limitations of an IQ-based construct of giftedness" (Lo & Porath, 2017, p. 347). The main limitations that were identified were that giftedness might be visible in various specific domains (e.g., mathematics, art, or music) instead of only the general intellectual domain. However, domain-specific talent is not always visible through standardized assessment in specific domains. This prompted us to try to look beyond traditional ways of using cognitively oriented tests and assessments. Analyzing children's human figure drawings (HFDs) might contribute to the identification process of gifted children and their needs (Mathijssen et al., 2016, 2018), if used in a larger test battery (Dykens, 1996). One of the benefits of drawings might be that—unlike academic abilities such as reading, writing, or arithmetic—drawing is a fun activity that is done very naturally from an early age on. Children between 2 and 4 years old already make scribbles, which are "drawn to be drawn" (Metin & Aral, 2020, p. 74), and over the years develop into intentional drawings and eventually into HFDs (Feltzer, 1975). Other benefits are that HFDs do not have to cost a lot of time and money, and that drawing is not often perceived as a threatening task (Flanagan & Motta, 2007).

Children's HFDs have long been used to measure cognitive and/or social-emotional development (Malchiodi, 1998). Clinicians, educators, and academics consider HFDs valuable tools for getting a view of children's cognitive and social-emotional development, and many use them to establish a more comprehensive picture of the whole child (Di Leo, 1983). However, researchers do not agree on the validity of HFDs (Piotrowski, 2015; Reisman & Yamokoski, 1973). Some researchers found positive relationships between drawing levels and cognitive functioning or development (e.g., Chappell & Steitz, 1993; Schepers et al., 2012). However, other researchers emphasized that "draw-a-person tests" aiming to measure cognitive functioning yield false positives for high

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intellectual functioning (Imuta et al., 2013). This is because scores derived from drawing tests correlate only modestly with scores from intelligence tests (Abell et al., 1996, 2001), and might be more related to visual-motor development than to intelligence (Dykens, 1996). Lilienfeld et al. (2000) therefore evaluated the scientific status of HFDs as "weak" (p. 51). Due to the diverging views on the usability of HFDs, we take the position that it is not advisable to use HFDs as substitutes for measuring intelligence and/or other giftedness components. Rather, HFDs might play a role as a screener that can produce indicators of giftedness that should then be followed up by more extensive assessment or monitoring.

The identification of gifted children (or rather their educational needs in order to develop their talents) goes further than assessing intelligence (e.g., Davis et al., 2014; Gottfried et al., 1994; Pfeiffer & Blei, 2008). Therefore, we think that the traditional scoring of HFDs on an overall level may not cover all relevant information that can be retrieved from HFDs. We thus started a research program consisting of multiple studies, in which we focus on another way to analyze HFDs: we explored whether item level data may reveal additional information from HFDs.

We investigated how children aged 4 to 6 draw human figures, in order to identify items that can be considered *nonexceptional* (i.e., occurring frequently) vs. *exceptional* (i.e., occurring infrequently). We explored whether the exceptional items could include indicators of giftedness. This information is relevant for both the scientific and the practical field. For the scientific field, this information might contribute to a more comprehensive view of expressions of giftedness. For the practical field, these insights may encourage the inclusion of HFDs in screeners that benefit the identification of gifted children and ultimately their educational needs, and the development of their talents. A screener means that HFDs could pick up first signs of giftedness in a large-scale fashion yet in a quick, low-cost, and accessible manner. This would be beneficial, since regular identification methods often involve extensive standardized methods conducted by professionals, such as intelligence tests (Card & Guiliano, 2015), which are time-consuming and therefore costly. Including drawing in the process might therefore serve a preventive cause, before problems occur, and pave the way for realizing education that fits the needs of gifted children as early as possible.

Analyzing HFDs

Until now, HFDs have often been used for measuring intelligence by computing "drawing-IQs," which represent standardized scores gained from comparing the sum of drawn items to norms of age and gender (e.g., Harris, 1963; Naglieri, 1988). However, additional information might be obtained by examining HFDs on an item level (Mathijssen et al., 2018). This is supported by two empirical studies in which the drawings of gifted and nongifted children were compared. Metin and Aral (2020) found no differences between the Drawing Evaluation Form scores of "children diagnosed as gifted" and "children of normal development" (p. 80). Dağlıoğlu et al. (2010) also found no relationship between IQ-scores and scores on the Koppitz (1968) HFD test, but based on both quantitative and qualitative item analyses, they did find that children with an IQ-score above 120 produced more detailed drawings than their normally developing peers. This suggests that analysis of HFDs on an item level might provide some insights about how giftedness may be expressed outside a traditional test setting. It thus seems to be fruitful to look beyond drawing-IQs when one aims to identify gifted children using HFDs (Mathijssen et al., 2018).

According to many models of giftedness, exceptional creativity is generally seen as (a part of) giftedness (Faber et al., 2021; Gagné, 2010; Kroesbergen et al., 2016; Piirto, 2013; Renzulli, 1976; Sternberg, 2004; Ziegler et al., 2013). Creativity can be defined as generating novel ideas and thinking flexibly and out of the box (Sternberg, 2004). As creativity (in terms of fluency, elaboration, and originality) is inherent to the process of drawing (e.g., Hui et al., 2015), gifted children are hypothesized to produce more elaborate and original drawings than typically developing children (Mathijssen et al., 2018). Of note, we expect this because creativity can be one component of giftedness—but it is not the only one. Consistent with this, scientific findings on the correlation between intelligence and creativity are divergent. For example, Kim (2005) found a small positive mean correlation in a meta-analysis and concluded that the correlation between IQ scores and creativity is "negligible" (p. 65) and Welter et al. (2016) found weak or no correlations (but see, Frith et al., 2021, who found a large latent correlation). Regardless, our study did not investigate a correlation between two scale scores. Instead, we think that novelty in drawings is likely best investigated at the item level—more specifically in exceptional items indicating fluency, elaboration, and originality. Accordingly, the item level was the focus of the present study.

Previous research

In order to investigate whether novelty as expressed in exceptionally occurring items can serve as a sign of giftedness in drawings, we analyzed HFDs in

a descriptive way and in a bottom-up fashion, meaning that we started with a blank sheet and noted all drawn items, instead of only using scoring systems, such as the Goodenough-Harris Drawing Test ([GHDT]; Harris, 1963) and the Draw a Person: A Quantitative Scoring System ([DAP:QSS]; Naglieri, 1988).

Although this may sound similar to the works of Guilford (1950) and Torrance (1974), who laid the basis for analyzing novelty and unique items expressed in drawings, the aim of our study was different from theirs. Where Guilford and Torrance tried to identify expressions of creativity or creative capacities, we tried to identify possible expressions of intellectual giftedness (i.e., the production of original drawings), and take the position that they might stem from the high creative capacities that gifted children possess according to many theories and models (e.g., Gagné, 2010; Mönks et al., 1985; Renzulli, 1976; Ziegler et al., 2013).

In a first explorative study (Mathijssen et al., 2016), we examined the HFDs of 120 children aged 7 to 9, initially using the GHDT (Harris, 1963) and the DAP:QSS (Naglieri, 1988). Both scoring systems were developed to measure the cognitive development of children by computing standard scores, known as drawing-IQs. As expected, we did not find any differences in drawing-IQs of children receiving full time gifted education and children receiving regular education. Closer examination, however, showed that both groups of children drew different items in the HFDs. Thirty items (like freckles, a goatee, and a head from the side) were only present (once or twice) in the drawings of the sample of gifted education children. We called these "exceptional items." Although these exceptional items may be individual and unique expressions, the common nature of the exceptional items was that they were additions to the human figure, without which the drawn figure would still be human (Mathijssen et al., 2016). Four items (among which were a nose piercing and knees) were only present once or twice within the drawings of the regular education children. The results suggested that the presence of exceptional items in HFDs might be related to giftedness in children, but additional replication was deemed necessary.

The present study

In the scope of our aforementioned research program, this study investigated which items are present in the drawings of children aged 4 to 6, how frequently these items occur (i.e., whether they are exceptional or nonexceptional), and if certain less frequent items occur more often in the drawings of gifted children. The goal of the present study was to provide a first step in the development of a screener for HFDs that can be used as part of the identification process of gifted children. Given the rapid course of development of HFDs of young children, including an increase of the number of items drawn with age (Cox, 1993; Feltzer, 1975), it is important to take note of the differences in items drawn at different ages. In the present study, the work of Koppitz (1968) served as an example for our analyses. Koppitz examined over 1,800 drawings of children aged 5 to 12 in order to develop her own scoring system. She called items occurring in 15% or less of the drawings "exceptional items." The relative frequency of exceptional items in samples of gifted children has, to our knowledge, not thoroughly been studied yet. Therefore, in order to gain insight about possible expressions of intellectual giftedness in drawings, the present study addressed two research questions.

The first research question was: "What items are drawn in HFDs of children aged 4 to 6, and how often do these items occur?" The frequencies would show what items are exceptional in children's HFDs, and which items are not. It was expected that items that generally consist of shapes that are essential to making a human figure (such as a head, eyes, arms, and legs) could, in the scope of the present study, be classified as "nonexceptional" (occurring in at least 15% of the drawings). Items that occurred in fewer drawings were called "exceptional items" (less than 15% of the drawings). Such exceptional items were expected to be of the same nature as the exceptional items we found in our previous study (2016): items that are not necessary to make the figure human and that were drawn only by intellectually gifted students. It was expected that the specific exceptional items would be different from the 2016 sample because children aged 4 to 6 generally draw less detailed human figures than children aged 7 to 9 (Cox, 1993; Feltzer, 1975). It was also expected that the most obvious differences would be observed when comparing drawings of children aged 4 to the drawings of children aged 5 and 6, since "tadpoles" are not uncommon in drawings by children aged 4, whereas children aged 5 and 6 more often draw human figures with a body (Feltzer, 1975). Also, the drawings of children aged 5 and children aged 6 were expected to be relatively similar (Feltzer, 1975).

The second research question was: "Do certain 'exceptional items' occur more often in the drawings of children aged 4 to 6 who are considered gifted?" It was expected that intellectually gifted children more often draw exceptional items when compared to a group of typically developing children.

Method

Participants

Participants were 206 children (108 boys, 98 girls) from three different elementary schools in the south of the

Netherlands. The schools were all part of the educational research lab POINT, in which researchers, teacher educators and teachers in the field of giftedness collaborate on research projects (Henrichs et al., 2017). The age span of the children was 4 to 6 years (M = 5.28, SD = 0.71). Seventy-two children were aged 4, 89 children were aged 5, and 45 children were aged 6. The children all received regular education.

Due to lack of possibilities to assign children to a subgroup of gifted children with use of creativity measures or ability tests such as the CogAT7 (Lohman, 2012) or the NNAT2 (Naglieri, 2008) and with knowledge that gifted children do not always achieve according to their potential (Emerick, 1992; Siegle & McCoach, 2018), teacher nomination was used to determine which children could be considered "developmentally advanced." Teacher nomination is an often-used method for identifying gifted children (Hoogeveen et al., 2004; Siegle et al., 2010), despite the limitation that teachers generally identify well-adjusted and well-performing children as gifted, while generally missing out on children from other cultural backgrounds or a lower socioeconomic status (Davis et al., 2014). However, we expected the teachers to be motivated to nominate the children the best they could, since they were teaching in schools that had a special interest in the topic of giftedness.

Seventeen children were considered developmentally advanced, according to their teachers. In the present study, we considered these children potentially gifted (PG). Of six of these children, the reason for their nomination was specified: three participated in pull-out programs (special programs for gifted pupils, mostly in small groups, during one day a week), one received enrichment in the regular class, one would receive enrichment in the following school year, and one was identified as gifted but no forms of enrichment were mentioned. The other children were considered to be typically developing (TD) in terms of cognition. To make comparisons between PG and TD children possible, 17 TD children were matched to the PG children based on age and gender. Although of some children in the total sample the teachers reported that they were of other than Dutch origin (e.g., Chinese or Turkish), this was not the case for the PG and TD children we matched.

Procedure and materials

The teachers of the schools were informed about the purpose of the study during a meeting. They then received further information through email and were instructed to ask the principals of their schools and the school boards to make it possible for the study to take place at their schools. A letter to the children's parent(s) or caretaker(s) (for ease of reading, hereafter called "parents") was sent via the schools, in which they were informed about the purpose of this study and were asked to grant permission for participation of their child.

The teachers handed out the drawing tasks according to a protocol. The investigators were not present during the drawing task to prevent possible influences of their presence. The teachers received the instructions by email and were asked to strictly follow them and were informed about the importance of doing so. The teachers gave the following verbal instructions for the HFD: "You will soon receive a blank sheet of paper. On the front, you will draw a human figure. Draw a full human figure. You can use the whole sheet. Draw the human figure, using only a gray pencil, without an eraser. When you are done drawing, lay down your pencil, so I can see I can collect your drawing."

After the instruction, the teacher handed out the blank sheets of paper of A4 size in portrait orientation, and the pencils. Children were allowed to rotate the sheet to landscape orientation. When a sign was given, the children were allowed to start drawing. Children were given approximately 15 minutes to complete their drawing. If children would ask questions about what to or what not to draw, a general answer (like: "You can draw the human figure however you like.") was provided by the teacher, as mentioned in the instructions. When during the drawing task something remarkable would happen that might have influenced the drawing (for example, a child becoming sick), a note was made on the back of the drawing. After the drawings were completed, the teacher collected the drawings.

The drawings were anonymized and marked with ID numbers on the backside of the sheet. A list with personal information about the children (name, gender, and date of birth) and the corresponding ID numbers was made, so the children could not be identified with only the drawing. A dataset containing only the ID numbers and the list with items was used by the investigators to ensure blind analysis. After the analysis of the drawings was completed by both investigators, gender and age were added to the dataset, in order to make comparison of children of the same age possible.

To analyze the drawings, a list of 158 items was used to be scored as "present" or "not present" in the drawing. The list consisted of three parts:

- Part 1: Initially Found (content) items, which were described in the Mathijssen et al. (2016) study
- Part 2: Formal items, which were described in the Harris (1963) and Naglieri (1988) studies

- Part 3: Newly Found (content or formal) items, which were observed in drawings of the present sample, but not described in the Initially Found or Formal items

Part 1 comprised 135 Initially Found items as observed in 120 drawings in our previous study (Mathijssen et al., 2016). This part of the list had been purpose-built by noting every perceivable item (for example, a head, eyes, and hands) within the drawings. In the previous study, the overall interrater agreement of two investigators, who analyzed the drawings blindly and independently, was 97.6%. Part 1 contained 30 items with an interrater agreement of 100% that were found in the previous study to be present only in the drawings of children receiving gifted education ("exceptional items"), and four items with an interrater agreement of 100% that were only found in the drawings of children receiving regular education ("contra-indicators," see, Mathijssen et al. (2016) for all exceptional items and contra-indicators). In order to investigate if the way *how* items are drawn (e.g., if body parts are in the correct proportion, and if the lines are drawn without irregularities) can be used for identification purposes of gifted children, 17 Formal items described by Harris (1963) and Naglieri (1988) (Part 2) were added to the present study. Six items that were perceived in the present study by both investigators, but not mentioned in our (Mathijssen et al., 2016), Harris (1963), or Naglieri's (1988) studies, were noted additionally (Part 3).

Data analysis

Two investigators (i.e., the first and second author of the present study) scored the drawings blindly and independently of each other to investigate what items were drawn in each child's HFD and how often these items occurred in the total sample and in each age group separately. The investigators had at least seven years of experience in analyzing HFDs (one of the investigators had several decades of experience). Based on this experience and due to the fact that no information about what children said they had drawn was available, we decided not to solve any discrepancies in the observations of both investigators but to analyze their data separately. Solving discrepancies between the investigators would not have guaranteed correct conclusions about the noted observations of items that apparently are multi-interpretable, after all.

The percentage of interrater agreement was determined by comparing each investigator's yes/no score on every individual item for each participant. All items were sorted in "occurrence categories" based on how often they were drawn:

- Nonexceptional items that occurred in 15% or more of the drawings
- Exceptional items that occurred in less than 15% of the drawings, but more than 0%

The cutoff at 15% is in line with Koppitz's (1968) ranges. The occurrence of items was first analyzed per investigator and consequently compared. This resulted in an overview of items and their occurrence, as observed by both investigators. If there were items that were placed in a different occurrence category, depending on the investigator, these items were considered neither nonexceptional nor exceptional, and no conclusions were drawn based on these items.

In order to investigate if certain exceptional items occurred more often in the drawings of PG children, the frequencies of observed exceptional items drawn by these children were compared to the observed exceptional items of the matched group of TD children. The focus was on items drawn only by children from either group. Due to the small subsamples size, no further division in age groups was made for the matched samples. No statistical tests were used because of the descriptive nature of this study and the limited number of children in each subgroup. This means that comparisons need to be interpreted cautiously.

Although similar to the way of analysis of the Torrance Test of Creative Thinking ([TTCT]; Torrance, 1974) by its focus on unique items in drawings, our aim is different from the TCTT. The TCTT aims to determine (the level of) creative capacities through these unique items, whereas our position on this matter is that what is drawn uniquely by intellectually gifted children represents creative abilities related to their intellectual giftedness (e.g., Gagné, 2010; Renzulli, 1976; Ziegler et al., 2013).

Results

Occurrences of drawn items in HFDs of the total sample

Of the Initially Found 135 items of the item list (Part 1), 111 items were observed, on which an overall interrater agreement of 95.4% was found. There were 28 items that were labeled as nonexceptional, among them a neck,

arms, hands, fingers, and feet. Also, a clear female or male figure was commonly observed. Some of the nonexceptional items (a head, eyes, mouth, trunk, and legs) were observed very often, namely in 84.5% or more of the drawings. There were 53 items that were labeled as "exceptional," among them a necklace, a thumb, more than one human figure, and (additional) animals. There were 30 items that were placed in a different occurrence category depending on the investigator (i.e., they were considered nonexceptional by one investigator and exceptional or not observed by the other).

Of the 17 Formal items (Part 2 of the item list), 16 were observed, on which an overall interrater agreement of 88.7% was found. There were 4 common Formal items (the trunk, head, legs, and arms in the correct proportions), and 5 exceptional Formal items (the mouth, fingers, and ears in the correct proportions, and well controlled lines in arms and legs). There were 7 Formal items that were placed in a different occurrence category depending on the investigator.

All 6 Newly Found items (Part 3 of the item list: use of the backside of the paper, a beard, a mustache, antennae, hair on the legs, and pubic hair) were exceptional items.

A complete overview of what items were drawn in the HFDs of the children and how often these items occurred is available here: https://www.researchgate.net/publication/356834182_Table-repository_RR-POINT1_2021.

Occurrences of drawn items in HFDs per age group

Children aged 4

Of the Initially Found 135 items (Part 1 of the item list), 84 items were observed. There were 18 nonexceptional items. Some items (a head, and eyes) were observed often. There were 42 exceptional items, among them the neck, arms, and legs drawn in more than just single lines. There were 24 items that were placed in a different occurrence category by the two investigators.

Of the 17 Formal items (Part 2 of the item list), 13 were observed. There were 2 nonexceptional Formal items (the trunk, and the head in the correct proportions), and 9 exceptional Formal items. It was found exceptional for children aged 4 to produce body parts in the correct proportion (with the exception of the head and the trunk) and with well controlled long lines. Proper placing of all facial features was not observed. There were 2 Formal items that were placed in a different occurrence category by the two investigators.

Of the 6 Newly Found items (Part 3 of the item list), 3 were exceptional (use of the backside of the paper, antennae, and pubic hair). The other 3 were nonexceptional.

Children aged 5

Of the Initially Found 135 items (Part 1), 103 items were observed. There were 35 nonexceptional items, among them fully attached arms and trunks, legs and trunks, and legs and feet. Some items (a head, eyes, legs, mouth, trunk, and a trunk drawn in more than just a single line) were frequently observed. There were 38 exceptional items, among them the nose drawn as more than just dots or a single circle, the page turned to landscape orientation, and more than one human figure. There were 30 items that were placed in a different occurrence category by the two investigators.

Of the 17 Formal items (Part 2), 16 were observed. There were 5 nonexceptional Formal items (the trunk, head, legs, arms, and mouth in the correct proportions), and 2 exceptional Formal items (the fingers, and ears in the correct proportions). There were 2 Formal items that were placed in a different occurrence category by the two investigators.

Of the 6 Newly Found items (Part 3), 3 were exceptional (use of the backside of the paper, a beard, and a mustache). The other 3 were nonexceptional.

Children aged 6

Of the Initially Found 135 items (Part 1), 95 items were observed. There were 33 nonexceptional items, among them the correct number of fingers, and fully attached arms and hands, arms and trunk, legs and trunk, and legs and feet. Some items (a head, eyes, legs, mouth, trunk, and a trunk drawn in more than a single line) were frequently observed, of which the head, eyes, and mouth occurred in every HFD. There were 30 exceptional items, among them a navel, surroundings, additional text, and the page turned horizontally. There were 32 items that were placed in a different occurrence category by the two investigators.

Of the 17 Formal items (Part 2), 13 were observed. There were 7 nonexceptional Formal items (the trunk, head, legs, arms, feet, nose, and mouth in the correct proportions), and 1 exceptional Formal item (fingers in the correct proportions). There were 5 Formal items that were placed in a different occurrence category by the two investigators.

Of the 6 Newly Found items (Part 3), 3 were exceptional, and 1 was placed in a different occurrence category by the two investigators. The other 2 were nonexceptional.

Summarizing results

In Table 1, an overview of the number of items considered exceptional and items considered nonexceptional per age group is presented, based on the combined observations of two investigators.

Regarding the Initially Found 135 items, the number of items that were labeled as exceptional was highest in the

Table 1. Overview of the number of items considered exceptional and items considered nonexceptional per age group, based on the combined observations of two investigators.

		Initially Found Items (135)		Formal Items (17)		Newly Found Items (6)	
	n	≥ 15%	< 15%	≥ 15%	< 15%	≥ 15%	< 15%
4-year-olds	72	18	42 (of which 6 exceptional in 2016 sample)	2	9	0	3
5-year-olds	89	35	38 (of which 6 exceptional in 2016 sample)	5	2	0	3
6-year-olds	45	33	30 (of which 3 exceptional in 2016 sample)	7	1	0	3

age group of 4 and decreased from year to year, which was in line with our expectations. The same is true for the 17 Formal items. All Newly Found items were exceptional and occurred equally often in the three age groups. There were 13 items that were considered exceptional in all age groups.

Frequencies of exceptional items in HFDs of PG and TD children

See, Table 2 for an overview of the frequencies of exceptional items in drawings of the matched subsamples of PG and TD children. Of the 13 items that were exceptional in all age groups in the present study, 3 items were observed more often in the drawings of PG children, 3 items more often in the drawings of TD children, and 1 item was drawn by neither group in the matched subsamples. Two exceptional items were only observed in the drawings of TD children. There were 6 items that were observed to a different extent by the two investigators (i.e., they were seen more often in the drawings of PG children by one investigator and more often in the drawings of TD children by the other). Of the 30 items that were drawn only by gifted children in our previous study, 3 items were again observed only in the drawings of PG children (a frame around the human figure, genitals, and animals). See Figure 1 for examples of drawings with exceptional and nonexceptional items.

Discussion

Occurrences of drawn items in the total sample

As expected, items clearly recognizable as basic characteristics of a humanoid figure occurred commonly and in the correct proportion in HFDs of children aged 4 to 6. Items that were classified as exceptional included the production of well controlled long lines, and fine details and/or additions to the human figure. Clothing appeared to be the only exception to this statement; although clothing is an addition to and not necessary for making a human figure, clothing

Table 2. Overview of frequencies of exceptional items in the drawings of potentially gifted (PG) and typically developing (TD) children.

Item	Matched Sample (*N* = 34)			
	Investigator 1		Investigator 2	
	Observed in Drawings of PG Children	Observed in Drawings of TD Children	Observed in Drawings of PG Children	Observed in Drawings of TD Children
Hands and fingers as a whole	2	4	2	4
Headgear	3	3	3	2
Nasal bridge	3	2	2	2
Crotch	2	1	3	0
Ground underneath the human figure	1	2	1	1
Headband	2	1	2	0
Teeth	2	1	2	0
Ears (more than a half circle)	0	2	0	2
Page turned horizontally	1	1	1	1
Shoes	0	2	0	1
Thumb	0	0	1	0
Multiple human figures[a]	1	1	1	1
Animal(s)[a]	1	0	1	0
Frame around the human figure[a]	1	0	1	0
Genitals[a]	1	0	1	0
Waist[a]	1	0	0	1
Color[b]	0	1	0	0
Mucus[b]	0	1	0	0

Note. Exceptional items that were not observed in the drawings of this matched sample are not included in this table. See Table 2 for all exceptional items.
[a]Items drawn only by gifted children in our previous study (2016) and considered exceptional in the present study. [b]Items drawn only by gifted children in our previous study (2016), but not considered exceptional in the present study.

Figure 1. Top: drawing of a PG girl aged 4 years and 10 months that shows the presence of the exceptional item "frame around the human figure" and the nonexceptional item "clothing (upper body)." Name written on paper is censored. Bottom: Drawing of a TD girl aged 6 years and 2 months that shows the presence of the nonexceptional item "clothing (upper body)."

for both the upper and the lower body was observed commonly by both investigators. Partially in line with our expectation that the specific exceptional items would be different from our previous study, of the 53 items that have been labeled as exceptional in the present study, 6 were only observed in the drawings of gifted children and 1 was observed only in the drawings of nongifted children in our previous study (2016). The remaining 46 exceptional items were thus uniquely found in the present study.

Occurrences of drawn items per age group

Based on the frequencies of drawn items per age group, what is considered exceptional and nonexceptional differed between all three age groups, which is not fully in line with our expectation that the drawings of children aged 5 and 6 would be more similar. Similarities across all age groups were also observed. Some basic characteristics, such as arms, feet, hair, nose, hands, and fingers, were frequently observed. A head and eyes were observed often. Some fine details and/or additions to the human figures (such as headgear, a thumb, genitals, shoes, the page turned horizontally, and the use of the backside of the paper) were exceptional items in all age groups, with the exception that text was commonly added in the drawings of 5-year-olds. It is remarkable that genitals were observed only in the drawings of gifted children in our previous study (2016) and were also considered exceptional in the present study. Also, the presence of pubic hair stands out. Whether or not this particular focus is a possible expression of intellectual giftedness or of something else is yet unclear and deserves further investigation.

The results also indicate that there is more conventionality in drawings of 5- and 6-year-olds than in drawings of 4-year-olds. In drawings of 5- and 6-year-olds, there appears to be a higher number of nonexceptional items than in drawings of 4-year-olds. Concerning exceptional items, 4-year-olds seem to draw more items that can be labeled as exceptional than 6-year-olds. A trend of a decrease in number of exceptional items thus appears as children grow older, just like Koppitz found in her 1968 study. It is in line with our expectation based on Feltzer (1975) that the number of exceptional items was highest in 4-year-olds. There are a number of possible reasons for this. First, 4-year-olds may pay more attention to essential features of a human figure (such as a head, eyes, nose, and mouth) than to additional details without which the figure would still be human (such as ears, lips, and nostrils). Second, certain items may be especially hard for 4-year-olds to draw (such as hands fully attached to the arms, and fingers consisting of two lines).

Frequencies of exceptional items drawn by PG and TD children

Three items that were drawn only by gifted children in the previous study were also drawn only by PG children in the present study (i.e., genitals, animals, and a frame around the human figure). Although these items deserve special interest for future research, it is too early to consider them indicators of giftedness based on the present data, due to the small subsamples size, the lack of statistical analyses, and teacher nomination being the only method of identification. Remarkably, some exceptional items (i.e., ears as more than just a half circle, and shoes) in the present study were drawn only by TD children—which is contraindicatory.

Limitations and future research

The present study has a number of limitations, rendering the findings to be treated with care. To the extent of our knowledge, with the exception of Koppitz (1968) study, there have been no studies that analyzed HFDs in the same descriptive way as in the present study. Therefore, there are not many possibilities to compare the findings of this study to other studies. We hope that our research spurs additional studies into this topic.

In the present study, the number of participants was limited. Over 200 children is not a small sample size, though in comparison to Koppitz (1968) study, which had over 1,800 participating children, it is limited when trying to give an overview of the population. The relatively small sample size also resulted in a relatively small number of potentially gifted children to investigate. For future research, a larger group of participants is desired to increase the robustness of the findings. This is particularly important for the matched subsamples because no comparisons between PG and TD children within a separate age group were possible in the present study, due to low numbers of participants in the subsamples per age (six in 4- and 6-year-olds, 22 in 5-year-olds). It is for this reason that we did not perform statistical analyses, making it impossible to differentiate trends in the data from statistically significant patterns.

Using a larger group will also make it possible to take social and cultural aspects, like SES and ethnicity, into account. When taking these aspects into account, it is advisable to use local norms over national norms, because local norms have been found to significantly increase the identification of gifted students who are of Latin or African American origin in the United States (Peters et al., 2019). For future research, this social connection could be made, for example, by comparing drawings form children with diverse sociocultural backgrounds.

Some teachers expressed insecurity when talking about (potentially) gifted children: "I know he is smart, but I am not sure whether he is gifted." This insecurity may result in misidentification. Also, the teachers of the children who participated in the present study appeared to be somewhat reserved when asked to identify a potentially gifted child and no preliminary staff development was ensured. Even though the teachers were teaching in schools that had a special interest in the topic of giftedness, it might be beneficial for future studies to include staff training in identifying potentially gifted children.

Another limitation of teacher nomination is that teachers may mainly identify well-adjusted children (Davis et al., 2014) who perform well in school subjects that are considered important, such as reading and math (Siegle et al., 2010), or students who express a higher than average working memory capacity (Kornmann et al., 2015). This may have caused selection bias in our sample of potentially gifted children, and accordingly our findings need to be carefully evaluated. In addition, the information provided by the teacher varied from "pull-out class" to a more extensive elaboration as to why they thought a particular child could be intellectually gifted. Of note, nearly all elaborations focused on curricular adaptations that were already made and thus confirming the possible bias that may result from teacher nomination. Teacher nomination should therefore not be considered a very conclusive method. At the time of the data collection for the present study, however, other methods of identifying gifted children were not available.

To be able to draw solid conclusions about intellectually gifted children, future (replication) studies should include concurrent validity evidence. However, even with a recognized and validated creativity measure or ability test, such as the CogAT7 (Lohman, 2012) or the NNAT2 (Naglieri, 2008), we should take into consideration that gifted children do not always achieve according to their potential (Emerick, 1992; Siegle & McCoach, 2018).

In addition, it is important to use valid methods to select potentially gifted students in a more conclusive way than teacher nomination. For our own research, one part of the avenues for future research on HFD is a follow-up study. We have already collected more information about the education received by the children who participated in the present study. We did that by asking the parents of the children if any adaptations were made to the curriculum of their child(ren), 2

years after we collected the drawings. This information is added to the dataset. Children who received any form of education generally aimed at meeting the needs of gifted children will be considered potentially gifted, based on the revised Elementary and Secondary Education Act of 2002 (in Ambrose & Machek, 2015). With these new data, a comparison between drawings of PG and TD children will be made again. We hope by doing so, we can overcome the limitations of teacher nomination and varying information provided, lack of insight in the children's capacities at the time of drawing, and to reduce the number of unidentified gifted children.

At the time of the drawing tasks, no researchers were present and no checks were done to ensure that the teachers abided by the instructions. We have no reasons to assume that the teachers did not follow the instructions because the effort the teachers were asked to invest was reduced as much as possible and we did not find drawings with indications that the instructions were not followed. That said, it would be of added value for future research to ensure all drawings are produced according to the same instructions.

It is recommended for future research to take young ages into account when aiming for exceptionality expressed in drawings. Exceptionality tends to be more visible in the drawings of young children and the number of nonexceptional items increase with age. However, the drawings of younger children were also more difficult to interpret, and a substantial number of items was placed in a different occurrence category, depending on the investigator (note that Koppitz, 1968 study did not include the age group of 4). For example, a print on the upper body clothing was considered nonexceptional for 4-year-olds by the first investigator, but exceptional by the second investigator. This suggests that drawn items are not always interpreted in the same way by different people. For future research, it might be advisable to have a conversation with the child about what is present in the drawing.

Given the nature of the exceptional items of our previous study (Mathijssen et al., 2016) and the nature of the exceptional items in the present study, we cannot be conclusive about individual items as expressions of giftedness—especially not at the individual level. For example, although it is remarkable that genitals were an exceptional item in both the previous and the present study (i.e., found only in the sample of [potentially] gifted children), it is certainly too soon to consider the drawing of genitals an indicator for possible giftedness. Possibly, clustering of certain items (e.g., clustering "nostrils" and "nasal bridge" into "nose") may provide more accurate information about the way gifted children draw human figures, as is suggested in a somewhat different context by Riethmiller and Handler (1997), and Koppitz (1984). Future research might therefore aim to investigate co-occurring exceptional items that are drawn by gifted children. Also, within a yet to be developed diagnostic system, a number of exceptional items might be conceived of as a special category, of which the presence of one or more items could be an indication of giftedness in young children (given the increase of nonexceptionality with age).

In the identification procedure of (potentially) gifted children, it is important to not only take into account cognitive development, but also social and emotional development. Children's HFDs have since long been used to also measure the social and emotional development of children (Malchiodi, 1998). However, if, and how, analysis of HFDs on the social and emotional level can contribute to the identification procedure of (potentially) gifted children has to the extent of our knowledge not been studied yet.

In addition to paying attention to cognitive, social and emotional development, it may also be advisable to take into account fine motor development. Although the presence of Formal items as described by Harris (1963) and Naglieri (1988) require a certain level of fine motor skills and spatial ability, the actual level of these skills was not determined in the present study. Drawing is found to be related to fine motor ability (Rehrig & Stromswold, 2018) and visuospatial ability in young children (Toomela, 2002). Future studies might benefit from assessing fine motor and spatial skills, in order to reduce the chance of confusing children with high fine motor and/or spatial skills for children who express signs of giftedness in their drawings.

Finally, a follow-up study, for which preparations have already been undertaken, should provide a more solid empirical basis for our position that the exceptional items found in the present study may indicate the need for a more challenging curriculum. Consequently, this follow-up study will improve the empirical foundation for a screening instrument to identify this need.

Practical implications

Based on the present study and in line with findings from previous studies, caution is advised if using HFDs as a screening tool to identify gifted children and their needs. The present findings by themselves do not justify the use of HFDs as a screening tool. At the same time, however, the present study does not oppose the practical value of HFDs, because it is an important step within the full research program, and, through that, in deriving implications that can be put into practice. With the results of this study, we are one step closer to a well-founded analysis of exceptionality expressed in

drawings, and with that also a step closer to identifying (and serving) those children who require services or activities not ordinarily provided by the school in order to fully develop their high abilities. In addition, we may have found a new way of analyzing HFDs that offers new perspectives for future research on HFDs in general, after the critical evaluation of existing scoring systems.

At this moment, caution should still be exercised when analyzing HFDs, due to different findings in our previous study (Mathijssen et al., 2016) and our present study. What was considered exceptional in the previous study was not necessarily exceptional in the present study. Therefore, one should not rely (solely) on the outcomes of our previous or present study when analyzing HFDs. We are still exploring the (exceptional) items drawn by 4- to 6-year-olds, comparing the drawings of "potentially gifted" children and "typically developing" children. In clinical or school practice, it is strongly recommended to always use the information gained from drawings as a screener (i.e., an instrument that requires *additional* information as follow-up), and/or as a topic to talk about, not as the leading or most important source of information on which conclusions about a child are based. In order to provide suitable education, it might not always be necessary to assess students more extensively first. A drawing made in class might serve as a quick, low-cost and accessible form of universal screening as recommended by Plucker and Peters (2018), and as an initial indication for teachers that additional monitoring or assessment (using a more extensive battery of tests) is desired.

Conclusion

The present study serves as a first step for a screener for human figure drawings that can be used as part of the identification process for gifted children and their (educational) needs. The findings indicate that this new way of analyzing human figure drawings on an item level, rather than computing drawing-IQs, can contribute to the process of identifying giftedness in children at a very young age. We started by looking for exceptional items in human figure drawings of children aged 4, 5, and 6 years. The results show that the number of items that can be labeled as exceptional differs between the age groups, with the highest number being found in the drawings of 4-year-olds. Despite the greater difficulty in determining what exactly these young children have drawn, this finding means that exceptionality in drawings of gifted children might be most visible in human figure drawings of children at the age of 4. As in the previous study, certain items (e.g., genitals and a waist) were drawn more frequently or exclusively by a small group of potentially gifted children when compared to typically developing children. However, further research with larger groups of children is required to draw more solid conclusions.

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References

Abell, S. C., Von Briesen, P. D., & Watz, L. S. (1996). Intellectual evaluations of children using human figure drawings: An empirical investigation of two methods. *Journal of Clinical Psychology*, *52*(1), 67–74. https://doi.org/10.1002/(sici)1097-4679(199601)52:1%3C67::aid-jclp9%3E3.0.co;2-t<67::AID-JCLP9>3.0.CO;2-T

Abell, S. C., Wood, W., & Liebman, S. J. (2001). Children's human figure drawings as measures of intelligence: The comparative validity of three scoring systems. *Journal of Psychoeducational Assessment*, *19*(3), 204–215. https://doi.org/10.1177/073428290101900301

Ambrose, L., & Machek, G. R. (2015). Identifying creatively gifted students: Necessity of a multi–method approach. *Contemporary School Psychology*, *19*(3), 121–127. https://doi.org/10.1007/s40688-014-0020-z

Card, D., & Guiliano, L. (2015, September). *Can universal screening increase the representation of low income and minority students in gifted education?* (w21519). https://doi.org/10.3386/w21519

Chappell, P. A., & Steitz, J. A. (1993). Young children's human figure drawings and cognitive development. *Perceptual and Motor Skills*, *76*(2), 611–617. https://doi.org/10.2466/pms.1993.76.2.611

Cox, M. V. (1993). *Children's drawings of the human figure*. Psychology Press.

Dağlıoğlu, H. E., Çalışandemir, F., Alemdar, M., & Bencik-Kangal, S. (2010). Examination of human figure drawings by gifted and normally developed children at preschool period. *Elementary Education Online*, *9*(1),

31–43. Retrieved from https://dergipark.org.tr/en/pub/ilkonline/issue/8596/106951
Davis, G. A., Rimm, S. B., & Siegle, D. (2014). *Education of the gifted and talented* (6th ed.). Pearson Education.
Di Leo, J. H. (1983). *Interpreting children's drawings*. Brunner-Routledge.
Dykens, E. (1996). The draw a person task in persons with mental retardation: What does it measure? *Research in Developmental Disabilities*, *17*(1), 1–13. https://doi.org/10.1016/0891-4222(95)00032-1
Emerick, L. J. (1992). Academic underachievement among the gifted: Students' perceptions of factors that reverse the pattern. *Gifted Child Quarterly*, *36*(3), 140–146. https://doi.org/10.1177/001698629203600304
Faber, I. R., Sloot, L., Hoogeveen, L., Elferink-Gemser, M. T., & Schorer, J. (2021). Western approaches for the identification and development of talent in schools and sports contexts from 2009 to 2019—A literature review. *High Ability Studies*, 1–34. Advance online publication. https://doi.org/10.1080/13598139.2021.1900792
Feltzer, M. (1975). De tekening in de ontwikkelingspsychologie. [The drawing in developmental psychology.]. *Gedrag: Tijdschrift voor Psychologie*, *4*, 283–313.
Flanagan, R., & Motta, R. W. (2007). Figure drawings: A popular method. *Psychology in the Schools*, *44*(3), 257–270. https://doi.org/10.1002/pits.20221
Frith, E., Elbich, D. B., Christensen, A. P., Rosenberg, M. D., Chen, Q., Kane, M. J., Silvia, P. J., Seli, P., & Beaty, R. E. (2021). Intelligence and creativity share a common cognitive and neural basis. *Journal of Experimental Psychology: General*, *150*(4), 609–632. https://doi.org/10.1037/xge0000958
Gagné, F. (2010). Motivation within the DMGT 2.0 framework. *High Ability Studies*, *21*(2), 81–99. http://dx.doi.org/10.1080/13598139.2010.525341
Gottfried, A. W., Gottfried, A. E., Bathurst, K., & Wright Guerin, D. (1994). *Gifted IQ: Early developmental aspects: Fullerton longitudinal study*. Plenum Press.
Guilford, J. P. (1950). Creativity. *American Psychologist*, *5*(9), 444–454. https://doi.org/10.1037/h0063487
Harris, D. B. (1963). *Children's drawings as measures of intellectual maturity*. Harcourt, Brace, & World.
Henrichs, L., Schot, W., Zuiker, I., Bakx, A., Soeterik, I., Edzes, H., Klein, T., de Jong, A., & Exalto, R. (2017, November 29–December 1). *Educational research labs in the Netherlands: A joint venture in connecting the worlds of educational practice and research* [Paper presentation]. The European Association for Practitioner Research on Improving Learning Conference, Hämeenlinna, Finland. https://research.ou.nl/ws/portalfiles/portal/22193784/ProgrammePracticalGuideEAPRIL2017_Final_1.pdf
Hoogeveen, L., Van Hell, J. G., Mooij, T., & Verhoeven, L. (2004). *Onderwijsaanpassingen voor hoogbegaafde leerlingen. Meta–analyses en overzicht van internationaal onderzoek*. [Educational adjustments for gifted students. Meta-analyses and survey of international research.]. Radboud University, CBO/ITS.
Hui, A. N. N., He, M. W. J., & Ye, S. S. (2015). Arts education and creativity enhancement in young children in Hong Kong. *Educational Psychology*, *35*(3), 315–327. https://doi.org/10.1080/01443410.2013.875518
Imuta, K., Scarf, D., Pharo, H., & Hayne, H. (2013). Drawing a close to the use of human figure drawings as a projective measure of intelligence. *PLoS One*, *8*(3), e58991. https://doi.org/10.1371/journal.pone.0058991
Kim, K. H. (2005). Can only intelligent people be creative? A meta-analysis. *The Journal of Secondary Gifted Education*, *16*(2–3), 57–66. https://doi.org/10.4219/jsge-2005-473
Koppitz, E. M. (1968). *Psychological evaluation of children's human figure drawings*. Grune & Stratton.
Koppitz, E. M. (1984). *Psychological evaluation of human figure drawings by middle school pupils* (2nd ed.). Allyn & Bacon.
Kornmann, J., Zettler, I., Kammerer, Y., Gerjets, P., & Trautwein, U. (2015). What characterizes children nominated as gifted by teachers? A closer consideration of working memory and intelligence. *High Ability Studies*, *26*(1), 75–92. https://doi.org/10.1080/13598139.2015.1033513
Kroesbergen, E. H., Van Hooijdonk, M., Van Viersen, S., Middel-Lalleman, M. M. N., & Reijnders, J. J. W. (2016). The psychological well-being of early identified gifted children. *Gifted Child Quarterly*, *60*(1), 16–30. https://doi.org/10.1177/0016986215609113
Lilienfeld, S. O., Wood, J. M., & Garb, H. N. (2000). The scientific status of projective techniques. *Psychological Science in the Public Interest*, *1*(2), 28–66. https://doi.org/10.1111/1529-1006.002
Lo, C. O., & Porath, M. (2017). Paradigm shifts in gifted education: An examination vis–à–vis its historical situatedness and pedagogical sensibilities. *Gifted Child Quarterly*, *61*(4), 343–360. https://doi.org/10.1177/0016986217722840
Lohman, D. F. (2012). *Cognitive abilities test form 7: Research and development guide*. Riverside.
Malchiodi, C. A. (1998). *Understanding children's drawings*. The Guilford Press.
Mathijssen, A. C. S., Feltzer, M. J. A., & Hoogeveen, L. (2016). Identifying highly gifted children by analyzing human figure drawings: An explorative study. *Talent Development and Excellence*, *8*(1), 41–53. Retrieved from https://www.point013.nl/wp-content/uploads/2017/04/Onderzoek-Sven-Mathijssen.pdf
Mathijssen, A. C. S., Feltzer, M. J. A., & Hoogeveen, L. (2018). Identifying highly gifted children by analyzing human figure drawings: A literature review and a theoretical framework. *Psychological Test and Assessment Modeling*, *60*(4), 493–515. Retrieved from https://www.psychologie-aktuell.com/fileadmin/Redaktion/Journale/ptam-2018-4/05_PTAM_Q4_Mathijssen.pdf
Metin, S., & Aral, N. (2020). The drawing development characteristics of gifted and children of normal development. *Cypriot Journal of Educational Science*, *15*(1), 073–084. https://doi.org/10.18844/cjes.v15i1.4498
Mönks, F. J., Van Boxtel, H. W., Roelofs, J. J. W., & Sanders, M. P. M. (1985). The identification of gifted children in secondary education and a description of their situation in Holland. In K. A. Heller & J. F. Feldhusen (Eds.), *Identifying and nurturing the gifted: An international perspective* (pp. 39–65). Hans Hubers.
Naglieri, J. A. (1988). *Draw a person: A quantitative scoring system*. The Psychological Corporation.
Naglieri, J. A. (2008). *Naglieri nonverbal ability test* (2nd ed.). NCS Pearson.
Peters, S. J., Rambo-Hernandez, K., Makel, M. C., Matthews, M. S., & Plucker, J. A. (2019). Effect of local norms on racial and ethnic representation in gifted education. *AERA Open*, *5*(2), 1–18. https://doi.org/10.1177/2332858419848446

Pfeiffer, S. I., & Blei, S. (2008). Gifted identification beyond the IQ test: Rating scales and other assessment procedures. In S. I. Pfeiffer (Ed.), *Handbook of giftedness in children: Psycho-educational theory, research, and best practices* (pp. 177–198). Springer Science+Business Media.

Piirto, J. (2013). But isn't everyone creative? In K. Kim, J. Kaufman, J. Baer, & B. Sriraman (Eds.), *Creatively gifted students are not like other gifted students* (pp. 213–230). Sense Publishers.

Piotrowski, C. (2015). Projective techniques usage worldwide: A review of applied settings 1995–2015. *Journal of the Indian Academy of Applied Psychology*, *41*(3), 9–19. Retrieved from https://www.researchgate.net/publication/273004208_Projective_techniques_usage_worldwide_A_review_of_applied_settings

Plucker, J. A., & Peters, S. J. (2018). Closing poverty-based excellence gaps: Conceptual, measurement, and educational issues. *Gifted Child Quarterly*, *62*(1), 56–67. https://doi.org/10.1177/0016986217738566

Rehrig, G., & Stromswold, K. (2018). What does the DAP:IQ measure?: Drawing comparisons between drawing performance and developmental assessments. *The Journal of Genetic Psychology*, *179*(1), 9–18. https://doi.org/10.1080/00221325.2017.1392281

Reisman, J. M., & Yamokoski, T. (1973). Can intelligence be estimated from drawings of a man? *Journal of School Psychology*, *11*(3), 239–244. https://doi.org/10.1016/0022-4405(73)90030-7

Renzulli, J. S. (1976). The enrichment triad model: A guide for developing defensible programs for the gifted and talented. *Gifted Child Quarterly*, *20*(3), 303–326. http://dx.doi.org/10.1177/001698627702100216

Riethmiller, R. J., & Handler, L. (1997). Problematic methods and unwarranted conclusions in DAP research: Suggestions for improved research procedures. *Journal of Personality Assessment*, *63*(3), 459–475. https://doi.org/10.1207/s15327752jpa6903_1

Schepers, S., Dekovič, M., Feltzer, M., De Kleine, M., & Van Baar, A. (2012). Drawings of very preterm-born children at 5 years of age: A first impression of cognitive and motor development? *European Journal of Pediatrics*, *171*(1), 43–50. https://doi.org/10.1007/s00431-011-1476-8

Siegle, D., & McCoach, B. (2018). Underachievement and the gifted child. In S. I. Pfeiffer, E. Shaunessy-Dedrick, & M. Foley-Nicpon (Eds.), *APA handbook of giftedness and talent* (pp. 559–573). American Psychological Association.

Siegle, D., Moore, M., Mann, R. L., & Wilson, H. E. (2010). Factors that influence in–service and preservice teachers' nominations of students for gifted and talented programs. *Journal for the Education of the Gifted*, *33*(3), 337–360. https://doi.org/10.1177/016235321003300303

Sternberg, R. J. (2004). Successful intelligence as a basis for entrepreneurship. *Journal of Business Venturing*, *19*(2), 189–201. https://doi.org/10.1016/S0883-9026(03)00006-5

Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2011). Rethinking giftedness and gifted education: A proposed direction forward based on psychological science. *Psychological Science in the Public Interest*, *12*(1), 3–54. https://doi.org/10.1177/1529100611418056

Terman, L. M. (1926). *Genetic studies of genius. Mental and physical characteristics of a thousand gifted children* (Vol. 1). Stanford University Press.

Toomela, A. (2002). Drawing as a verbally mediated activity: A study of relationships between verbal, motor, and visuospatial skills and drawing in children. *International Journal of Behavioral Development*, *26*(3), 234–247. https://doi.org/10.1080/01650250143000021

Torrance, E. P. (1974). *Torrance tests of creative thinking: Norms–technical manual*. Personal Press.

Welter, M. M., Jaarsveld, S., Van Leeuwen, C., & Lachmann, T. (2016). Intelligence and creativity: Over the threshold together? *Creativity Research Journal*, *28*(2), 212–218. http://dx.doi.org/10.1080/10400419.2016.1162564

Ziegler, A., & Stoeger, H. (2012). Shortcomings of the IQ-based construct of underachievement. *Roeper Review*, *34*(2), 123–132. https://doi.org/10.1080/02783193.2012.660726

Ziegler, A., Vialle, W., & Wimmer, B. (2013). The actiotope model of giftedness: A short introduction to some central theoretical assumptions. In S. N. Phillipson, H. Stoeger, & A. Ziegler (Eds.), *Exceptionality in East Asia: Explorations in the actiotope model of giftedness* (pp. 1–17). Routledge.

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