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The Test for Creative Thinking–Drawing Production Test in Preschool Children with Predominantly Migration Background—Psychometrics of the German TCT-DP

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The study examined the psychometric properties of the German version of the Creative Thinking – Drawing Production Test (TCT-DP). This test evaluates creative potential with 14 content-related criteria, constituting a total score. Age norms exist for children from 4–16 years. A total of 269 children with predominantly migrant background, aged 36–71 months, from German preschools participated. Total scores of 4- and 5-year-old children were significantly below the German age norms published in the test manual, but did not differ with the degree of the migrant background (both vs. one or none migrant parents). In contrast to boys, scores from girls were slightly higher. Discriminant validity could be confirmed: Total scores did correlate neither with intelligence, nor with gender, fine motor skill, educational, or socio-economic status of the parents. The German TCT-DP respectively revealed acceptable internal consistency (Cronbach's α = .69–.73). For the first time, cumulative percentages for 3-year-olds are provided as a kind of preliminary age norm. The German TCT-DP proved to be applicable in 3-year-old children with migrant background, albeit not all content-related criteria can be interpreted. Its psychometric properties support its use for research rather than for clinical purposes.

Creativity has often been described in the literature as a stable trait characterizing a person. However, many cultural and developmental factors are also likely to influence a person's creative potential (Csikszentmihalyi & Robinson, 2014). Young children are inherently creative, but various researchers noted a decline of the potential for creativity up to adulthood (Laughton, 1988; Sternberg & Lubart, 2001; Urban, 1991a, 1991b, 1995). This loss might be troublesome, especially because creative expression facilitates self-efficacy (Bandura, 1986) and promotes resilience, as children learn that they can alter the world through their own actions (Carr & Vandiver, 2003; Eisner, 1982).

A number of studies have shown that arts-training in the broadest sense may increase creative art-making of children (Anderson & Yates, 1999; Carr & Vandiver, 2003; Catterall & Peppler, 2007; Dziedziewicz, Oledzka, & Karwowski, 2013; Garaigordobil, 2005, 2006; Hui, He, & Sam, 2015; Laughton, 1988; Moga, Burger, Hetland & Winner, 2000; Murray, 1998; Rostan, 1997; Sowden, Clements, Redlich, & Lewis, 2015; Winner & Hetland, 2000). Stimulating creative potential may notably be beneficial for various populations such as potentially vulnerable ones, for example children with migrant background. However, so far, this has been understudied, and a condition to determine the need or the effect of arts-training is the possibility to measure creative potential properly. Such research is highly relevant in view of the growing percentage of people with migration background living in Europe, and particularly in Germany. The term "migrant background" is used here as "a proxy for children and their families coming to Germany from another country with the intention of living here—not only with another language but also with another culture and different social characteristics" (Kiese-Himmel, Witte, Islam, & Von Steinbüchel, 2015, p. 47).

Creative potential in childhood can be viewed as both an expression of a child's general development and as a factor

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stimulating this development (Dziedziewicz et al., 2013). Drawing, one example of creative activity, is strongly associated with fine motor skill linked to the increase of visual and tactile-proprioceptive abilities including spatial orientation. More specifically, in the development of drawing, a facet of creative potential, a sequence from scribbling, via drawing preschematically, schematically, preperspective, to drawing with perspective (visual realism) can be observed with increasing results in products of higher creative expression (Kiese-Himmel, 2013). Some previous research demonstrated age effects when assessing creativity with the German TCT-DP (Urban & Jellen, 1995). According to the test authors, the age-related increase in creativity is not linear, but follows a step-like progress. Up from the age of 11 years, Urban and Jellen (1995) did not detect significant changes in the German norm sample. It is likely that a child's level of creative potential may differ depending on the individual general developmental age and, especially, on the individual fine motor skill development. Gender might also play a role, as a recent study of preschool children reports higher levels of creativity for girls, compared to boys (Reunamo et al., 2014). In an Iranian study of Sholeh and Samaneh (2008), with 240 children from preschool and elementary schools, however, no significant difference in the development of creativity between boys and girls was found. Summed up in brief, many studies did not find differences, but some reported female superiority (Abraham, 2015).

Until now, only a few tests assessing creativity in children have been published in Germany, for example the *Kreativitätstest für Vorschul- und Schulkinder [Creativity test for preschool and school children]* from 4 to 11 years (Krampen & Freilinger, 1996), based on a narrow definition of creative potential focusing on divergent thinking and divergent acting. For this study, the German TCT-DP (TSD-Z; Urban & Jellen, 1995) was chosen, as it represents a comprehensive operationalization of creative potential. It comprises thinking; general as well as specific knowledge; specific skills, focusing and task commitment; motivation and motives; and, lastly, openness and tolerance of ambiguity. It aims at measuring not only fluency and flexibility, but also qualitative aspects and originality of a creative product. The test has been validated for the assessment of children from the age of 4 years up to adulthood, but not for 3-year-olds. The aim of this study was to examine the psychometric characteristics of the German TCT-DP in children from 3 years on.

METHOD

Participants

All participants of this study were engaged in a longitudinal study investigating the effectiveness of music- or arts-based education on children's cognitive, perceptual, language, motor, emotional, and social skills in children from 3 to 6 years of age, with a predominantly migration background. The study was approved by the University Medical Center Göttingen Ethics Committee and conducted in seven preschools located in and around Frankfurt/Main, Germany. Families were provided with detailed study information and could withdraw their children from the study at any time. Written informed consent was obtained from parents, as well as approval from the preschool councils. Test data collection, as well as socio-demographic information (by psychologists and educational science and psychology students under supervision) started in 2009 and was finalized in 2016. No incentives were given. Information on the level of education and occupation of the main breadwinner constituted a socio-economic status variable with five distinct categories: *unemployed* (0); *unskilled workers* (1); *skilled workers* (2); *professionals* (3); and *professionals with advanced qualifications/managers* (4). Additionally, the educational background (no school; primary school; secondary school; vocational training; university graduation) of both parents and other essential variables, like native language, were collected by asking the parents, too. Moreover, information on migration background of both parents was collected.

For this analyses, only baseline test data (before intervention) of the aforementioned project were used. These used 269 children (128 boys, 141 girls) with a mean age of 49.89 months (SD = 9.6). Most of them had a migration background with a non-German native language (Table 1). The native language of 76 children (28.3%) was German, 16.4% (N = 44) spoke Turkish, 13.4% (N = 36) Arabian, and nearly 5 % (N = 13) Twi, a Ghanaian language. Other languages were represented less in the sample. The educational and socio-economic status of the mother and the father of a child, as well as the migration background of the parents, is shown in Table 1.

Measures

German TCT-DP (TSD-Z; Urban & Jellen, 1995). The test is considered an individually administered screening instrument providing a rough estimation of a person's creative potential. The *TSD-Z* can widely be administered without language. It consists of two test-forms (A and B) containing basic fragments intended to stimulate further drawing. Form A and B have opposite patterns that are 180 degrees reversed. Children were asked to complete two drawings with a pencil. They were assured that they could not fail and that everything they produce would be correct. Fourteen key criteria constituting, as a whole, the TCT-DP construct, were used for coding the completed drawing resulting in an overall (total) score (ranging from 0 to 72):

1. *Continuation* (score 0–6),
2. *Elaboration/Completion* (score 0–6),
3. *New elements* (score 0–6),
4. *Connections graphic* (score 0–6),
5. *Connections thematic* (score 0–6),

TABLE 1
Characteristics of the sample

		Other native language (N = 192)	*German native language (N = 77)*	*All (N = 269)*
		N (%)	*N (%)*	*N (%)*
Gender	Boys	91 (47.4%)	37 (48.1%)	128 (47.6%)
	Girls	101 (52.6%)	40 (51.9%)	141 (52.4%)
	All	**192 (100%)**	**77 (100%)**	**269 (100%)**
Age (months)	Mean; SD	50.73; 9.7	47.86; 9.3	49.89; 9.6
	(Range)	(36–71)	(36–71)	(36–71)
Children's Native Language	German	-	77	77
	Other	192	-	192
	All	**192 (100%)**	**77 (100%)**	**269 (99.6%)**
Educational background*				
Mother	No School	3 (1.6%)	-	3 (1.1%)
	Primary School	20 (10.4%)	-	20 (7.4%)
	Secondary School	77 (40.1%)	11 (14.3%)	88 (32.6%)
	Vocational Training	60 (31.3%)	47 (61.0%)	107 (39.6%)
	University Education	25 (13%)	17 (22.1%)	42 (15.6%)
	All	**185 (96.4%)**	**75 (97.4%)**	**260 (96.3%)**
Father	No School	-	-	-
	Primary School	8 (4.2%)	-	8 (3.0%)
	Secondary School	72 (37.5%)	9 (11.7%)	81 (30.0%)
	Vocational Training	77 (40.1%)	38 (49.4%)	115 (42.6%)
	University Education	22 (11.5%)	20 (26.0%)	42 (15.6%)
	All	**179 (93.3%)**	**67 (87.1%)**	**246 (91.2%)**
Migration Background*				
	0 German Parents	182 (94.8%)	14 (18.2%)	196 (73.7%)
	1 German Parents	7 (3.6%)	22 (28.6%)	29 (10.9%)
	2 German Parents	2 (1.0%)	39 (50.6%)	41 (15.4%)
	All	**191 (99.4%)**	**75 (97.4%)**	**266 (98.9%)**
Socio-economic Status*				
Mother	Unemployed	118 (61.5%)	24 (31.2%)	142 (52.6%)
	Unskilled worker	18 (9.4%)	1 (1.3%)	19 (7.0%)
	Skilled worker	25 (13.0%)	16 (20.8%)	41 (15.2%)
	Professional	7 (3.6%)	22 (28.6%)	29 (10.7%)
	Advanced qualification	10 (5.2%)	10 (13.0%)	20 (7.4%)
	All	**178 (92.7)**	**73 (94.9%)**	**251 (92,9%)**
Father	Unemployed	22 (11.5%)	4 (5.2%)	26 (9.6%)
	Unskilled worker	31 (16.1%)	8 (10.4%)	39 (14.4%)
	Skilled worker	92 (47.9%)	23 (29.9%)	115 (42.6%)
	Professional	23 (12.0%)	15 (19.5%)	38 (14.1%)
	Advanced qualification	15 (7.9%)	17 (22.1%)	32 (11.9%)
	All	**183 (95.4%)**	**67 (87.1%)**	**250 (92.6%)**

* = missing data

6. *Boundary breaking fragment dependent* (score 0/3/6),
7. *Boundary breaking fragment independent* (score 0/3/6),
8. *Perspective* (score 0–6),
9. *Humor* (score 0–6),
10. *Unconventionality: manipulation of material* (score 0/3),
11. *Unconventionality: use of abstract or surrealistic elements* (score 0/3),
12. *Unconventionality: combination of figures with signs or symbols* (score 0/3),
13. *Unconventionality: not-stereotypical use of fragments* (score 0/3), and
14. *Time factor* (score 0–6).

Good interrater reliability of the German TCT-DP has been reported by Urban (2004). Urban and Jellen (1995) provided age norms (percentiles; T-scores) for a composite group of children aged from 4 to 6 years ($N_{4\ years}$ = 30; $N_{5\ years}$ = 32; $N_{6\ years}$ = 159) for Form A. Normative values exist for Form B from the age of six years on. According to these norms, percentiles < 10 should be considered very poor, 11–25 below average, 26–75 average, 76–90 above average, 91–97.5 far above average, and those scoring > 97.5 exceedingly above average.

Kaufman-Assessment Battery for Children–German Version (K-ABC; Melchers & Preuß, 2009). The K-ABC is a reliable and valid test assessing abilities of children

from 2.5 to 12.5 years with four global test scores: sequential processing, simultaneous processing, achievement, and nonverbal abilities. A general measure of intelligence (mental processing composite score) combines the result values (raw scores) of the two processing scales. The reliability of the mental processing composite score ranges from r = .90 (3;0–3;11 y.) to 0.94 (5;0–5;11 y.; see Melchers & Preuß, 2009). In our study, raw scores were transformed into age norms (M = 100, SD = 15), which in turn were transformed into T-scores (M = 50; SD = 10).

Vienna Development Test (Wiener Entwicklungstest WET; Kastner-Koller & Deimann, 2002). WET is a reliable and valid German developmental test for children of preschool age, comprising 13 subtests, including a parent questionnaire. The subtests assess visual, motor, learning/memory, cognitive, language, and socio-emotional development. For the purpose of this study, the Rasch homogenous subtest "Tracing" measuring fine motor skill was used. Each child was provided a paper and pencil and asked to copy 10 figures. The reliability of "Tracing" (the norm sample comprises an Austrian and a German group) is satisfactory (Cronbach's α = .77). Age norms provided by the test authors in the manual were applied (Centiles: M = 5; SD = 2).

RESULTS

Children generally understood the directions given to them. On average, they took 4.2 min (SD = 3.2; range 0.5–15) for Form A, and 3.3 min (SD = 2.7; range 0.5–15) for Form B. The time children spent on the drawing was positively related to their total score (Form A: r = .49; p < .001; Form B: r = .48; p < .001).

The total scores in Form A (M = 9.49, SD = 7.3; range 0–37) were found to be below that of the small norming samples reported by Urban and Jellen (1995). A one-sample t-test revealed that total scores (Form A) deviate significantly from the mean of the norm group, $t(146) = -9.561$; p < .001. Total scores in Form B ranged from 1–40 (M = 9.20, SD = 6.8), and we could not test the deviation from the mean of the norm groups, because norms exist only from the age of 6 years on. No significant difference between mean total scores of participants with migration versus German background could be found (M_{German} = 9.47; $M_{Migrant}$ = 9.38).

Children were rated for both forms (A, B) on each key criterion applying an ordinal scale (0–6 points). The percentages of each rating category on each criterion are presented in Table 2. Some criteria of the test evaluation were not applicable, as solely one child's drawing contained *perspective*, and only few children produced pictures containing *humor* (Form A: N = 16, 6.3%; Form B: N = 17, 7%). This also applies to the criterion *unconventionality: use of abstract or surrealistic elements* (Form A and Form B: N = 1, 0.4%), *unconventionality: combination of figures with signs or symbols* (Form A: N = 3, 1.1%; Form B: N = 5, 1.9%), and *unconventionality: not-stereotypical use of fragments* (Form A: N = 4, 1.5%; Form B: N = 2, 1.1%). However, children scored more frequently in the category *manipulation of the material* (Form A: N = 36, 13.3%; Form B: N = 48, 17.8%). Following the test instruction, a so-called time factor has to apply in the evaluation if the total test score was above 25 points. Through this, eight children received a speed bonus for Form A and four children for Form B.

As the scores of the two test forms (A and B) were significantly correlated (r = .63; p < .001) they were put together for subsequent analyses. The total scores of girls were slightly higher than the corresponding scores of boys. Girls were more likely to include *new elements* (r = .015), but did not differ from boys concerning the other criteria. Children scores did not differ according to their migration background (Table 3).

Concerning the missing age norms for 3-year-old children, we used the raw scores for our analyses. The criteria *perspective, humor, unconventionality*, and *time factor* were not applicable and, therefore, not examined. Both forms A and B were combined to generate composite categories of all variables. Interestingly, in both Form A and Form B, most criteria had a positive correlation among each other (Table 4). *Continuation* and *elaboration* were significantly, albeit slightly, associated with age, but moderately with the total score, like the criterion *new elements. Connections* and *boundary breaking* were slightly but significantly associated with age, too, but strongly with the total score. Children's intelligence was significantly positively correlated with parental education and with socio-economic status, although rather low. Fine motor skill had also a slightly positive correlation with parental education and socio-economic status. Gender showed no correlation to any other variable.

Reliability

Cronbach`s α coefficients ranged from .69 to .73. They showed acceptable and satisfactory internal consistencies for 3-year-old (.72), and for 4-year-old children (.73) as well as for the total sample (.72), but not for 5-year-olds (.69).

Validity

Convergent validity of the German TCT-DP with an adequate German test could not be determined as no instrument assessing creative potential with a comparable operationalization was available in Germany (see Urban, 2004). Discriminant validity (Table 4) resulted in a zero correlation between total scores and intelligence (r = .03), parental education (r_s = -.03) and socio-economic status (r_s = .01). Using an extreme group approach, the sample was split into a group with low creative potential and a group with high creative potential, based on the average score in Forms A and B, by taking the lowest and highest 25% scores of the total sample (Table 5). These two groups were compared on a number of variables (Figure 1). *High creative* (N = 72) and *low creative* (N = 70) children differed little in age (t = −2.05; p = .04), although the children of the higher creative group were 3 months older, on average. Both groups did not differ in their

TABLE 2
Percentage of children per scoring criterion for form A and form B in the German TCT-DP

Form A	*Points for each criterion (percentage)*						
Criterion	*0*	*1*	*2*	*3*	*4*	*5*	*6*
(1) Continuation	18.9	7.4	7	20.7	27	15.6	3.3
(2) Elaboration/Completion	67.8	14.4	4.1	5.9	4.4	3.0	0.4
(3) New Elements	32.6	22.2	13.7	8.5	7.8	3.7	11.5
(4) Connections: graphic	65.2	9.3	7.8	5.6	4.1	2.6	5.6
(5) Connections: thematic	88.1	0.7	2.6	4.8	0.7	1.1	1.9
(6) Boundary Breaking: fragment dependent	88.1			2.6			9.3
(7) Boundary Breaking: fragment independent	77			7.4			15.6
(8) Perspective	99.6	0.4	-	-	-	-	-
(9) Humor	93.7	3.7	1.1	1.1	-	0.4	-
(10) Unconventionality: manipulation/material	86.7			13.3			
(11) Unconventionality: abstract/surrealistic elements	99.6			0.4			
(12) Unconventionality: signs or symbols	98.9			1.1			
(13) Unconventionality: not-stereotypical	98.5	1.1	-	0.4			
(14) Time Factor	97.0	0.7	-	1.1	0.7	0.4	-
Form B							
(1) Continuation	21.5	7.8	5.2	27.0	23.3	10.7	4.4
(2) Elaboration/Completion	70.4	11.1	6.7	6.7	3.0	1.9	0.4
(3) New Elements	35.2	23.7	15.6	8.9	4.1	4.1	8.5
(4) Connections: graphic	68.1	7.8	9.3	4.4	4.1	3.7	2.6
(5) Connections: thematic	90.0	1.1	1.9	5.2	0.4	0.4	1.1
(6) Boundary Breaking: fragment dependent	86.7			4.1			9.3
(7) Boundary Breaking: fragment independent	71.5			9.6			18.9
(8) Perspective	100	-	-	-	-	-	-
(9) Humor	93.0	3.7	1.5	1.1	-	-	0.7
(10) Unconventionality: manipulation/material	82.2			17.8			
(11) Unconventionality: abstract/surrealistic elements	99.6			0.4			
(12) Unconventionality: signs or symbols	98.1			1.9			
(13) Unconventionality: not-stereotypical	98.9	0.7	0.4	-			
(14) Time Factor	98.5	-	0.4	0.4	0.4	0.4	-

intelligence ($t = -0.79$; $p = 0.43$), fine motor skill ($t = 0.40$; $p = .69$), parental education ($t = 1.03$; $p = .31$), and socio-economic status ($t = -0.69$; $p = .49$). The extreme-group validation showed significant higher total scores and scores for five key criteria for children in the group with high creative potential, against the group with creative potential (Table 5).

A hinted effect between boys ($n = 34$ low; $n = 24$ high) and girls ($n = 36$ low; $n = 48$ high) was seen, $\chi^2(1) = 3.41$; $p = .065$, showing a larger percentage of girls in the *high creative*, compared to the *low creative* potential group (Figure 2). No difference by migration status was detected, χ^2 (2) = 2.12; $p = .35$.

No standard values exist for 3-year-old children. Therefore, we calculated cumulative percentages for Form A, Form B and for the total score as a kind of tentative age norm for 3-year-old children with predominantly migration background (Table 6–8).

DISCUSSION

This study addressed psychometric quality of the TSD-Z (Urban & Jellen, 1995) in children 36–71 months of age, predominantly with migration background. In comparison to the German norm sample, our study participants performed with moderate quality; their results deviated significantly from the mean of the norm sample. Our preliminary findings demonstrated that fine motor skill was not related to children's total score. This result suggests that creative potential might be a unique feature at this age, which remains relatively unaffected by such a basic functional skill. Although all children were able to understand and complete the task, some particularities were observed concerning the content-related key criteria specified by the test authors. This applied to the criteria *perspective, humor, unconventionality*, and *time factor*, in which only few children scored. This result may be explained by the actual drawing developmental stage of the young study participants.

Overall, girls showed significantly higher scores in drawing *new elements*, and when data were split into a low- and a high-scoring group, girls were significantly more assigned to the high-, rather than to the low-scoring group. From a subjective observational perspective, it is possible that the type of task may have had an influence, because young girls appeared to enjoy drawing more than young boys; besides, girls often have a developmental lead in drawing, compared

TABLE 3
Mean scores (SD) in the German TCT-DP in the total sample – by gender and by migration background

	Total Score	*Continuation*	*Elaboration*	*New Elements*	*Connections*	*Boundary Breaking*
Total Sample	9.39	2.81	0.71	1.81	1.32	1.94
	(6.37)	(1.64)	(1.20)	(1.78)	(1.94)	(2.80)
Gender						
Boys	8.69	2.82	0.65	1.53*	1.33	1.68
	(6.05)	(1.65)	(1.16)	(1.62)	(1.97)	(2.51)
Girls	10.03	2.81	0.77	2.07*	1.32	2.19
	(6.60)	(1.64)	(1.24)	(1.88)	(1.92)	(3.04)
Migrant Background						
Both parents	9.43	2.83	0.73	1.80	1.28	1.87
	(6.40)	(1.63)	(1.22)	(1.81)	(1.93)	(2.78)
One parent German	9.14	2.76	0.55	1.78	1.09	2.69
	(5.14)	(1.74)	(0.95)	(1.53)	(1.27)	(2.98)
Both parents German	9.32	2.83	0.78	1.74	1.60	1.87
	(7.26)	(1.71)	(1.29)	(1.75)	(2.36)	(2.88)

Note: * p = .013

TABLE 4
Correlations for German TCT-DP total scores and evaluable key criteria with fine motor skill, intelligence (standard scores), gender, age, parental education and socio-economic status

	German TCT-DP							
	Total Score	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*Fine Motor Skill (Centile)*	*Intelligence (T-Score)*
TCT-DP Total Score	-	-	-	-	-	-	.00	.03
Continuation (1)	**.44*** **	-	-	-	-	-	.08	**.16***
Elaboration (2)	**.52*** **	**.36*** **	-	-	-	-	.04	**.15***
New Elements (3)	**.53*** **	**−.25****	.13	-	-	-	−.04	−.10
Connections (4)	**.63*** **	.11	**.23*** **	**.41*** **	-	-	.03	.06
Boundary Breaking (5)	**.69*** **	**.21*** **	**.23*** **	**.37*** **	**.21****	-	−.01	−.12
Gender	.10	.00	.05	.15	.03	.06	.11	.01
Age (months)	**.13***	**.17***	**.20*** **	.04	**.11***	**−.17***	−.13	.14
Parental education	−.03	.04	.12	−.09	−.06	.02	**.18***	**.27*** **
Socio-economic status	.01	−.06	.09	.03	.02	.03	**.19***	**.17***

* p < .05; ** p < .01; *** p < .001

to boys (Jenni, 2013; Koppitz, 1972). Our results are in line with those of Reunamo et al. (2014), who reported that Finnish preschool children's creativity in pretend play increased with age and that girls were more creative in their pretend play than boys. Chae (2003) also noted a significant effect of age and a slight, but significant advantage for girls (in Form B) when examining the German TCT-DP scores in a sample of 4- to 6-year-old children.

In our study group, children's age was slightly positively associated with the total score and moderately to strongly significant in five key criteria. This can be considered a result of growing maturity and differentiation in ontogenetic development. Jastrzębska and Limont (2017) reported in a study with Polish pupils, aged 7–18 years, that scores in TCT-DP increase with age, but that apart from levelling (between 10 and 13 years) it also drops in scores, and unchanged scores over two consecutive age groups may be due to educational and environmental modulators of development. The observed slight negative relationship of children's age and the criterion *boundary breaking* in our study is in concordance with Piaget's concept of egocentrism (Piaget, 1929). Furthermore, younger children may have been less inhibited by expectations, and had less developed behavioral regulative skills. The criteria *continuation* and *elaborations* were significantly positively correlated with intelligence. This suggests that the application of these criteria may require a certain level of maturity of cognitive abilities. This assumption is in line with developmental theories relating the development of creative abilities to children's individual cognitive development (Piaget, 1929; Vygotsky, 2004). A lack of flexible thinking may be explained by Piaget's concept of egocentrism, characteristically observed in the preoperational stage of cognitive development.

TABLE 5
Results of an extreme group validation comparing (low vs. high creative potential)

			Creative Potential						
	t-Test		Low (N = 70)		High (N = 72)		Differences		
Variable	t	sign.	Mean	SD	Mean	SD	Average Difference	95% CI	
Continuation	−7.06	0.00	1.78	1.53	3.53	1.42	−1.76	−2.25	−1.26
Elaboration	−7.79	0.00	0.07	0.26	1.50	1.53	−1.43	−1.79	−1.06
New Elements	−10.00	0.00	0.79	0.87	3.31	1.95	−2.53	−3.03	−2.03
Connections	−9.76	0.00	0.08	0.26	2.97	2.50	−2.89	−3.48	−2.30
Boundary Breaking	−12.27	0.00	0.09	0.43	4.94	3.33	−4.85	−5.64	−4.06
Total Score	−23.82	0.00	3.04	1.14	17.85	5.15	−14.81	−16.05	−13.57
Age (months)	−2.05	0.04	48.07	8.50	51.25	9.96	−3.18	−6.25	−0.11
Education (Parents)	1.03	0.31	2.79	0.68	2.66	0.77	0.13	−0.12	0.37
Intelligence	−0.79	0.43	46.62	8.90	47.84	9.01	−1.23	−4.29	1.84
Socio-economic status	−0.69	0.49	2.03	1.21	2.18	1.18	−0.15	−0.57	0.27
Fine Motor Skill	0.40	0.69	4.40	2.07	4.26	2.16	0.14	−0.56	0.85

Children's intelligence was significantly positively low correlated with parental education – a well-known fact (Gienger, Petermann, & Petermann, 2015) – however, not with the total score. We see this as evidence of discriminant validity of the TSD-Z. Creative potential at this age seems not only relatively unaffected by children's intelligence and fine motor skill, but also by social environment. This is confirmed by comparing participants with high creative potential and low creative potential, as their scores do not show any associations with any of these variables. However, further replication is necessary before any strong conclusions can be drawn. Although no significant difference between total scores of study participants with migration versus those with German background were noted, the lack of statistical significance eventually could be caused by the small sample size of children with native German parents.

Until this study, there was no information mentioned yet in publications concerning the internal consistency reliability of the German TCT-DP. Usually, reliability levels of .90 are classified as minimum standard for interpretation, but this is rarely achieved in a test like the TCT-DP. Our reliability analyses revealed acceptable internal consistency for the total sample (.72) and for the age groups of 3-year-old children (.72), as well as 4-year-olds (.73). The low Cronbach's α in the group of 5-year-old children, possibly caused by the small group size, is unsatisfactory.

The most important fact in the evaluation of any test is whether it measures accurately what it is intended to measure. This may be a problem in this case, because there exists no commonly accepted operational definition of *creativity*. Urban (2004, p. 391–392) stated that a correlation of

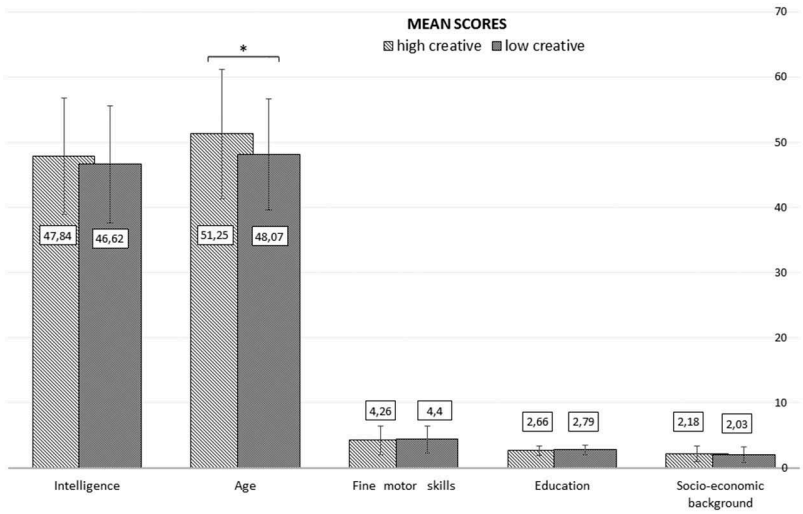

FIGURE 1 Differences of the mean scores between "high creative" and "low creative" children in sociodemographic variables, intelligence and fine motor skill.

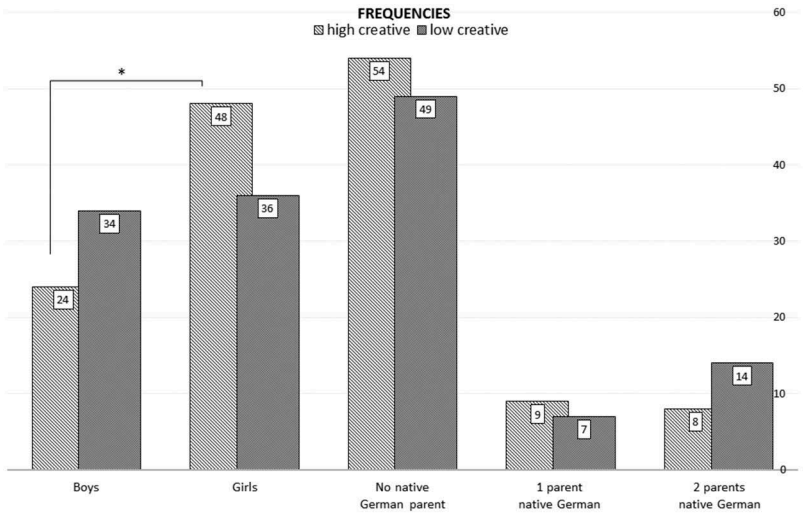

FIGURE 2 Differences between "high creative" and "low creative" children by gender, respectively, migration background.

TABLE 6
German TCT-DP, form A: Cumulative percentages (Cum %) for 3-year-old children (N = 123)

Score	*Frequency*	*%*	*Cum %*	*Score*	*Frequency*	*%*	*Cum %*
1	13	10.6	10.6	14	3	2.4	80.5
2	1	0.8	11.4	15	4	3.3	83.7
3	13	10.6	22.0	16	3	2.4	86.2
4	17	13.8	35.8	17	2	1.6	87.8
5	10	8.1	43.9	18	1	0.8	88.6
6	12	9.8	53.7	19	2	1.6	90.2
7	4	3.3	56.9	20	2	1.6	91.9
8	4	3.3	60.2	21	3	2.4	94.3
9	5	4.1	64.2	22	1	0.8	95.1
10	3	2.4	66.7	24	3	2.4	97.6
11	6	4.9	71.5	31	1	0.8	98.4
12	3	2.4	74.0	35	1	0.8	99.2
13	5	4.1	78.0	37	1	0.8	100.0

TABLE 7
German TCT-DP, form B: Cumulative percentages (Cum %) for 3-year-old children (N = 123)

Score	*Frequency*	*%*	*Cum %*	*Score*	*Frequency*	*%*	*Cum %*
1	13	10.6	10.6	13	5	4.1	79.7
2	3	2.4	13.0	14	5	4.1	83.7
3	11	8.9	22.0	15	5	4.1	87.8
4	14	11.4	33.3	16	1	0.8	88.6
5	11	8.9	42.3	17	3	2.4	91.1
6	8	6.5	48.8	18	3	2.4	93.5
7	5	4.1	52.8	19	1	0.8	94.3
8	6	4.9	57.7	20	1	0.8	95.1
9	6	4.9	62.6	21	1	0.8	95.9
10	5	4.1	66.7	22	1	0.8	96.7
11	7	5.7	72.4	23	2	1.6	98.4
12	4	3.3	75.6	32	2	1.6	100.0

TABLE 8
German TCT-DP, Total Score: Cumulative percentages (Cum %) for 3-year-old children (N = 123)

Score	*Frequency*	*%*	*Cum %*	*Score*	*Frequency*	*%*	*Cum %*
2	8	6.5	6.5	23	1	0.8	74.8
4	2	1.6	8.1	24	2	1.6	76.4
5	4	3.3	11.4	25	3	2.4	78.9
6	9	7.3	18.7	26	2	1.6	80.5
7	2	1.6	20.3	27	1	0.8	81.3
8	7	5.7	26.0	28	2	1.6	82.9
9	4	3.3	29.3	30	3	2.4	85.4
10	7	5.7	35.0	31	1	0.8	86.2
11	5	4.1	39.0	32	4	3.3	89.4
12	4	3.3	42.3	34	2	1.6	91.1
13	4	3.3	45.5	36	1	0.8	91.9
14	6	4.9	50.4	37	2	1.6	93.5
15	3	2.4	52.8	38	2	1.6	95.1
16	3	2.4	55.3	39	1	0.8	95.9
17	5	4.1	59.3	45	1	0.8	96.7
18	6	4.9	64.2	46	1	0.8	97.6
19	3	2.4	66.7	51	1	0.8	98.4
20	4	3.3	69.9	58	1	0.8	99.2
21	1	0.8	70.7	67	1	0.8	100.0
22	4	3.3	74.0				

zero between intelligence and the TCT-DP total score "adds to the validity of the test in the sense that the TCT-DP measures something different from academic achievement and conventionally understood intelligence". As already stated, we could confirm discriminant validity by missing relationship between intelligence and TCT-DP total score.

Standard values improve the interpretation of a child's test score. Current standard values are based on an old sample (see Urban & Jellen, 1995), and none exist for 3-year-old children. Standard values would allow correction for age and gender,

given that creativity scores differ based on these variables. In this article, we are providing cumulative percentages for Form A, for Form B, and for the total score as a kind of tentative age norm for 3-year-old children with predominantly migration background. A new standardization might, therefore, be warranted to increase reliability of the German TCT-DP for educational and clinical use.

There are some limitations to this study that may have affected the results. Our study sample consists of young participants and assessing psychological variables at this age is especially fluctuating. Although the sample is relatively large, it is not necessarily representative. The group sizes of boys and girls in the extreme group comparison were unequal. The lack of standard values for 3-year-old children required the use of raw scores in our statistical analysis what can be considered a limitation too. Thus, we think that it would not be fair to draw any conclusions concerning the children's development from poor performances on this test. In line with the recommendations of Urban (2004), we suggest that the test should be used only in conjunction with other information (such as general developmental age). Although the test is to recommend as a valid measure for research purposes, great care should be taken when using it in clinical and educational settings. Nevertheless, the German TCT-DP might be a valuable tool for cross-cultural research studies that aim to evaluate creative potential in young children, because the test material can be used without modification.

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