Creativity Research Journal

ISSN: 1040-0419 (Print) 1532-6934 (Online) Journal homepage: http://www.tandfonline.com/loi/hcrj20

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To cite this article: Jennifer Haase, Eva V. Hoff, Paul H. P. Hanel & Åse Innes-Ker (2018) A Meta-Analysis of the Relation between Creative Self-Efficacy and Different Creativity Measurements, Creativity Research Journal, 30:1, 1-16, DOI: 10.1080/10400419.2018.1411436

To link to this article: https://doi.org/10.1080/10400419.2018.1411436

Published online: 30 Jan 2018.

CREATIVITY RESEARCH JOURNAL, *30*(1), 1–16, 2018
Published with license by Taylor & Francis, LLC
ISSN: 1040-0419 print/1532-6934 online
DOI: https://doi.org/10.1080/10400419.2018.1411436

A Meta-Analysis of the Relation between Creative Self-Efficacy and Different Creativity Measurements

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This meta-analysis investigated the relations between creative self-efficacy (CSE) and creativity measures and hypothesized that self-assessed questionnaires would have a different relation to self-efficacy beliefs compared to other creativity tests. The meta-analysis synthesized 60 effect sizes from 41 papers (overall N = 17226). Taken as a whole, the relation between CSE and creativity measures was of medium size (r = .39). Subgroup analyses revealed that self-rated creativity correlated higher with self-efficacy (r = .53). The relation with divergent thinking (DT) tests was weak (r = .23). Creativity scales had a medium size relation (r = .43), and was stronger than the relation to verbal performance tasks (r = .27) and figural performance tasks (r = .19). In a comparison between measures focusing on the creative person (r = .47), the creative product (r = .32), and the creative process (r = .27), the person aspect was most strongly linked to CSE. Thus, the relation between self-efficacy and creativity measures is dependent on the type of measurement used, emphasizing the need for researchers to distinguish between different instruments—not the least between self-report scales and more objective test procedures. Conceptual implications are discussed and critique concerning the creativity concept is brought up.

Being the core motor of innovation and development, creativity is an important human characteristic or, perhaps, even something more: "a mode or essence of being that represents pure human potential" (Lemons, 2010, p. 151). To study and further this human characteristic or mode of essence, it is crucial to discuss what creativity is and how it can be measured or captured. Some measurements focus on creative process; others focus on actual creative performance (products) and these often involve solving a performance task. Another category of measurements consists of scale assessments of creativity and measures predominantly creative personality or creative identity, but may also focus on creative process or creative products. In relation to the large range of measurements, different aspects of the creativity concept exist. Apart from *process* and *product*, Rhodes (1961) also postulated that creativity can be studied as *person* and as *place* in his 4P model. Measurement scores for different creativity aspects are not highly associated. Associations around .30 are common (Batey, Furnham, & Safiullina, 2010; Carson, Peterson, & Higgins, 2005; Dollinger, Urban, & James, 2004; Furnham, Batey, Anand, & Manfield, 2008). The inconsistency of measures leads to critical thinking around the manifold creativity concept. There is a need to systematize what is known about the creativity concept and the existing measurements. How can

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different degrees of agreement between measures be understood? In a recent debate initiated by Glăveanu (2014), an increased effort by researchers in the field to build on each other's work was warranted.

Creative self-efficacy is the latest addition to creativity measurements and belongs to the group of measurements using self-assessment, but in this case it is acknowledged to tap people's subjective beliefs about their creative ability.

Opinions concerning the validity of self-assessment as a measurement of actual creativity is conflicting. There are those who question self-assessed creativity as a useful criterion (Reiter-Palmon, Robinson-Morral, Kaufman, & Santo, 2012); others claim that some types of self-assessments have validity, for example, counting real products (Carson et al., 2005; Dollinger, 2011). A third group of researchers has demonstrated that self-beliefs about one's creative ability is an important motivational factor to perform creatively (Carmeli & Schaubroeck, 2007; Farmer, Tierney, & Kung-McIntyre, 2003; Tierney & Farmer, 2011).

Pretz and McCollum (2014) asserted that the knowledge about the relationship between creative self-perceptions and creative performance is inconclusive. As one attempt to answer Glăveanu's call for more synthesizing efforts within the creativity field and to build on what has actually been done within the creativity field, this meta-analysis investigates the relation between different creativity measures and creative self-efficacy across 41 studies (see all the characteristics of the studies in Appendix A).

CREATIVITY AND MEASUREMENTS

Although there are many definitions proposed by researchers during the last century, nearly all of them include the two aspects of novelty and usefulness that are seen as the core of the creativity concept (Runco & Jaeger, 2012).

Several types of creativity measures exist (see Table 1). This study has divided them into two main types: performance tasks and ratings on scales. The first category consists of test procedures in which the participants perform a creative task that can be either verbal or figural. The second category of measures consists of evaluations made by the creative person or others (expert raters or e.g. supervisors at work places) on one or multiitem scales.

All the measurements differ as to what aspect of creativity they focus on: process, product, person, or place. Some intend to measure several aspects.

Among the performance tasks, there is also variation in the kind of creative process that is being measured. The type of creative process tested may involve either idea generation, combinatory ability, or restructuring ability (Antonietti & Iannello, 2008) and different test tasks are involved. Idea generation is often tested with DT tasks (Torrance, 1965). Combinatory strategies can be measured with either process tests such as Remote Associate Test (Mednick, 1962) or product tests such as Urban's Test of Creative Thinking Drawing Production (2004) or Amabile's collage test (1982). Restructuring can be tested by rebus tests (MacGregor & Cunningham, 2008) or insight problems as the candle problem (Duncker & Lees, 1945).

The self-assessed scales can either test personality traits as Gough Creative Person scale (1979), creative products by asking for hobbies (Batey et al., 2010; Dollinger, 2011), or professional production (Carson et al., 2005). There are also self-report questionnaires that ask about the creative process such as Runco, Plucker, and Lim's RIBS scale (2001). Questionnaires also touch upon creativity-related matters such as creative identity (Karwowski, Lebuda, & Wiśniewska, 2012) or creative self-efficacy (Tierney & Farmer, 2011), as will be dealt with in the following section.

SELF-EFFICACY

Self-efficacy refers to individuals' beliefs about their ability to perform in specific situations (Bandura, 1997). It influences what individuals try to accomplish, how they try it, and how much effort they spend on the process. It is not the competence itself that matters, but the mere belief about it (Lemons, 2010). Due to its motivational importance, self-efficacy appears to be essential to understand how to improve creative performance. The self-efficacy concept can be applied to any domain were performance is possible, either on a general level (e.g., Graham, 2011; Tammeneifer & Motaghedifard, 2014), or in more specific domains, such as creative self-efficacy (Karwowski, 2011, 2012; Pretz & McCollum, 2014; Tierney & Farmer, 2011), or on an even more specific level, such as CSE applied to classroom settings (Beghetto & Baxter, 2012; Beghetto, Kaufman, & Baxter, 2011; Choi, 2004).

Creative self-efficacy is defined as "the belief one has the ability to produce creative outcomes" (Tierney & Farmer, 2002, p. 1138). How self-efficacy are believed to be related to creativity is the same for all three levels: Individuals are much more likely to engage in tasks if they assume they will accomplish something and regard themselves as potentially successful. The motivation for a behavior is high when one expects a positive outcome.

THE RELATION BETWEEN CREATIVITY AND CREATIVE SELF-EFFICACY

The past decade, studies investigating the relation between creative performance and creative self-efficacy have increased. Most find a positive relation between creative performance and people's general and also creative self-efficacy beliefs. However, the studies vary in the reported strength of the association. Some researchers found strong relations between the two concepts up to .85 (Chuang, Shiu, & Cheng, 2010). Other studies reported no, or only a marginal, relation between the two concepts

(Graham, 2011, $r = -.04$; Karwowski, 2011, $r = .15$; Richter, Hirst, Van Knippenberg, & Baer, 2012, $r = .09$; Simmons, Payne, & Pariyothorn, 2014, $r = .06$). This can indicate that there are variables that moderate the relations. For example, Lemons (2010) demonstrated, in an extensive qualitative study with students, that there is actually a great gap between students reporting positively about their potential creative abilities and their actual performances. Many of those who reported barely any creative performances said that they believed they could perform superbly. Therefore, it could be assumed that those who missed the chance to actually be proven wrong about their abilities reported high creative potential in the first place as they—like most people—like to think positively about themselves and exaggerate their own virtues (better-than-average effect; Alicke & Govorun, 2005). Additionally, Lemons found the pattern that most of those self-appointed creative persons held the assumption that creativity is a skill given by nature, which one has or has not and which appears by chance. On the other hand, those who engaged in actual creative activities reported opposing ideas; creativity meant hard work, a skill that needs training and a lot of effort. So belief in one's creative potential is not everything. The ability to realistically analyze one's actual creative possibilities and the attitude toward creative efforts are equally important. Unfortunately, those two factors are rarely assessed in common creativity studies, so they cannot be part of the analysis here.

Because researchers so far did not address possible reasons why there is such diversity in the strength of relations between self-efficacy and creativity measures, it is of special interest to investigate the link by applying meta-analytic methods. Following the literature on the relation between self-efficacy and creativity, it seems likely that the variety of conceptualizations of creativity will be part of explaining the great range of effect sizes.

This study was designed to investigate whether there is systematic variation as a function of measurement differences. Lemons´ study (2010) suggested that people are inaccurate in their self-perception. Because self-efficacy beliefs are, per definition, self-assessed, other self-report measures will be more likely to be associated with them. Whereas objective measurements of creativity (process measures, actual performance measures, and, possibly, also evaluations by others) are independent from self-bias and social desirability and are thus less likely to be related to self-efficacy beliefs. In detail, the analysis tested the following assumptions:

1. There is a positive relation between creativity and (creative) self-efficacy beliefs across all studies.
2. Self-assessment measures of creativity show stronger association to self-efficacy measures than other creativity measures.
3. The smallest relation can be found between "objective" creativity measures like DT and self-efficacy measures, compared to all the other non-DT measures.
4. The association between creativity and self-efficacy should increase with the level of assessment: More specific self-efficacy assessments correlate higher than general self-efficacy measures with creativity measures.

Because several additional bits of information from each study was retrieved (country of origin, year of publication, kind of sample, age of sample, percentage of females in sample, type, and aspect of creativity measure), those were used to explore further influences on the relation between creativity and self-efficacy. The exploratory part was focused on the association between creativity and self-efficacy concerning the different ways of measuring creativity (scales, verbal tests and figural tests), as well as on the link between creativity and self-efficacy concerning the four P´s of creativity (person, process, product—place was not measured within the papers in our meta-analysis).

METHODS

Study Selection

A literature search was conducted in Scopus, PsychINFO, and PsychARTICLE databases until the February 22, 2015. First, a keyword search was done, using the terms *creat*, self-efficacy*, and *self-confidence*. The 368 articles found were sorted based on the abstracts into *suitable, maybe suitable*, and *unsuitable* according to whether the articles dealt with exactly both concepts. A second rater coded, independently, 100 randomly selected abstracts in the same way. The interrater agreement was 75%. One-hundred-thirteen articles were selected as *maybe* and *suitable*, from which 39 were finally included into the analysis after reading the articles. All those articles actually included an effect size about the relation between creativity and self-efficacy. Second, researchers who have authored at least two articles from those 39 were contacted and asked for further unpublished data. Finally, a call for data, unpublished or soon-to-be-published, was done with the help of social networks and the European Association of Social Psychology. Two more datasets were obtained in this way, making a total of $k = 41$ independent studies with a combined sample size of $N = 17{,}226$ people. Some participants were counted several times, because some articles reported several effect sizes from the same sample. Criteria to compare the measurements used in the articles with each other were based on the schema for separating creativity questionnaires and tests by Hoff, Carlsson, and Rasulzada (2014; see Table 1).

Statistical Computations

The meta-analysis used correlation coefficients as the effect size the studies were compared with. Correlation coefficients are commonly used as effect sizes in meta-analyses, within and

TABLE 1
Overview of creativity tests and their test methods, types and aspects

	Examples of tests	*Type*	*Aspects*
One or multi-item scales			
Self-assessment	- Creative Person Scale (CPS, Gough, 1979)	Verbal	Person
	- Creative Behavior Index (CBI, Dollinger, 2011)	Verbal	Product
	- Biographical Index Creativity Behavior (BICB, Batey, 2007)	Verbal	Product
	- Creative Activity Questionnaire (CAQ, Carson et al., 2005)	Verbal	Product
	- Runco's ideational scale (RIBS, Runco, Plucker, & Lim, 2001)	Verbal	Process
	- Creative Climate Questionnaire (CCQ, SOQ, Ekvall, 1990)	Verbal	Place
	Creative Self-Efficacy (Tierney & Farmer, 2002)	Verbal	Person
	The Short Scale for Creative Self (SSCS, Karwowski et al., 2012)	Verbal	Person
Assessments by others	- E.g, experts/supervisors assess innovation rate for company/person	Verbal	Product
Performance Tests *Creative Process Type*			
Idea-generation *(divergent thinking, flexibility, variation)*	-Unusual Uses Tests (UUT, Guilford)	Verbal	Process
	-Torrance Test of Creative Thinking (TTCT, Torrance, 1965)	Figural and verbal	Process
Combination *(association)*	-Amabile's collage task	Figural	Product
	-Amabile's haiku task (1982)	Verbal	Product
	-Test of creative Thinking Drawing production (TCT-DP, Urban, 2004)	Figural and verbal	Product
	-Remote Associate test (RAT, Mednick, 1962)	Verbal	Process
Rearrangement (insight, restructuring)	-Duncker's candle problem (Duncker & Lees, 1945)	Figural	Process
	-Rebus test (MacGregor & Cunningham, 2008)	Figural/verbal	Process

outside of creativity research (e.g., Boer & Fischer, 2013; Gajda, Karwowski, & Beghetto, 2017; Karwowski & Lebuda, 2016; Pettigrew & Tropp, 2006). This is because of their widespread use and because they are easily transformable to other effect sizes, including the amount of explained variance, R^2, and Cohen's *d* (Borenstein, Hedges, Higgins, & Rothstein, 2005).

This meta-analysis follows the PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009).

Statistical analysis was mainly done with the program *R* with the formulas as described in Borenstein et al. (2005) and the *R* package rmeta (Lumley, 2015). The calculations were partly double-checked with the program *comprehensive meta-analysis* (Borenstein et al., 2005). The whole analysis was repeated excluding outlier studies (high sample size, Karwowski, 2011; high variance of the effect size, Robbins & Kegley, 2010), but because this brought no noteworthy difference to the original results, both studies were kept in the analysis.

Dealing with Multiple Outcomes within a Study

In total, 41 studies were included, with 71 effect sizes between creativity measures and self-efficacy. However, effect sizes obtained from the same sample are not independent and would cause incorrect estimates of the variance of the summary effect (Borenstein, Hedges, Higgins, & Rothstein, 2009; further explanation concerning the summary effect under *Computing mean correlation*). To avoid this bias, the effects sizes from all those studies in which several measures from a DT test were reported (fluency, flexibility, originality, elaboration; Pretz & McCollum, 2014; Robbins & Kegley, 2010; Karwowski et al., 2012; Tamannaeifar & Motaghedifard, 2014), were aggregated to one effect size by calculating the weighted mean correlation. The variance was calculated based on the variance of each effect size and the correlation between the measures (compare Borenstein et al., 2009, p. 228, formula 5 and 6). When the correlation between the creativity measures was unknown (Karwowski et al., 2012), it was assumed to be .30, because creativity measurements often correlate with each other around this size (cf. Carson et al., 2005). Due to this aggregation, the number of effect sizes decreased from 71 to 60.

RESULTS

Computing Mean Correlation (Hypothesis I)

Before calculating the summary effect, the nested data were dealt with. All studies with several effect sizes from one sample were aggregated to one mean correlation, resulting in a further reduction of the total amount of effect sizes to 47. A random-effects model was assumed, because the studies differed to some extent, due to different types of measurements with different focus on creativity and self-efficacy. The aim was to estimate the overall effect size that is influenced by the variation of true effects across the studies and the within-study error. Because the results of each study were differently powerful depending on the number of participants and effect size, the correlations of each study was weighted accordingly. Using a Fisher-transformation, each study contributed to the mean correlation based on their calculated weight. Applying a random-effects weights, the summary estimate of the correlation was $r = .40$ (interpreted as a Pearson correlation coefficient) with a 95% confidence interval (*CI*) of .32 to .47. In comparison, the

overall mean correlation based on 60 effect sizes (therefore, including nested data) differed only marginally with $r = .39$, 95% *CI* of .32 to .45 ($r = .50$ for correlations corrected for reliability, with a 95% *CI* of .40 to .59). Because the further analyses were based on these 60 effect sizes, the corresponding summary effect was used in the following. The dispersion of effect sizes from all studies can be seen in Appendix B1. This summary estimate supported the first hypothesis, stating that the overall effect size between all studies was of medium size.

Heterogeneity

A random-effect model states that the true effect sizes vary from study to study. This must be identified and quantified to understand the pattern of effects. The dispersion of the true effects sizes can only be estimated using the observed effect sizes. The true variation of effect sizes was calculated according to the procedure presented by Borenstein et al. (2009). For this meta-analysis, the ratio between the variation across studies (Q) and the error within studies (df) was substantially greater than zero: $Q = 1507.88$ with $df = 59$, $p < .0001$. To know which part of this dispersion was real, a ratio between the variance between studies to the total variance was calculated: $I^2 = 96.09$. The interpretation of I^2 is similar to R^2 in regression analysis. Put simply, I^2 measures what proportion of the observed variance between studies was real and did not occur based on the within-study variance. Only if this marker is greater than zero, a subgroup analysis is justified because there are actual variations between the true effect sizes across the studies (Borenstein et al., 2009).

Subgroup Analysis (Hypothesis II, III, IV)

Because estimates of heterogeneity suggested different true effect sizes between the studies, subgroup analyses were conducted to find the criteria on which those differences were based. First, hypothesis II proposed a difference of effect size based on the measurement used for creativity, with self-assessments correlating much higher than other kinds of test. Therefore, all those studies that used self-assessment measures of creativity were compared with those that used others. A Z-test, similar to a t-test in a primary study, was conducted to compare the mean effects for both subgroups (29 studies for self-rated; 31 for nonself-rated). Results supported hypothesis II: Studies that used self-assessment measures of creativity correlated significantly higher with (creative) self-efficacy measures ($r = .53$) than those using other assessment methods, such as performance tasks and expert-ratings ($r = .25$; compare Table 2, Figure 1 and Appendix B2).

Hypothesis III proposed the smallest relation between objective creativity tests with self-efficacy measures. Studies that used DT tests (eight effect sizes) were compared to those that used other tests (52 effect sizes; non-DT). Unfortunately, from those eight correlations, three were based on general-self-efficacy scales, which might be an influencing variable in favor of the hypothesis (compare hypothesis IV). Still, the results supported hypothesis III: Studies that used DT measures of creativity correlated significantly lower with (creative) self-efficacy measures ($r = .23$) than those studies using other methods than DT ($r = .41$; compare Table 2, Figure 2 and Appendix B3).

To test hypothesis IV, a Q-test for heterogeneity was performed. Here, the subgroups being compared to each other were treated as single studies in a meta-analysis and statistical values were computed as in hypothesis I. All studies within each

TABLE 2
Z-Test under random-effects model for subgroup-analysis with separate estimates of the true effect size per group

	Hypothesis II		*Hypothesis III*	
	Effect Sizes for Self-Rated C	*Effect Sizes for Non-self-Rated C*	*Effect Sizes for DT-C*	*Effect Sizes for Non-DT-C*
r	.53	.25	.23	.41
LL_r	.44	.18	.12	.34
UL_r	.60	.31	.33	.48
Z_{Diff}	−3.62		2.12	
p	.0003		.034	

Notes. r is the mean effect size for each subgroup; LL_r is the lower limit of r; UL_r is the upper limit of r; Z_{Diff} is the difference between two groups; p the statistical significance of the difference.

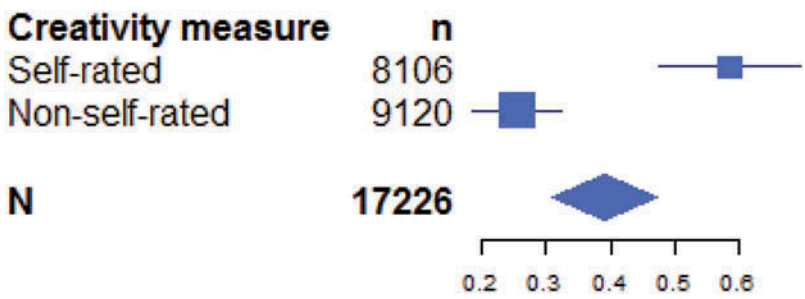

FIGURE 1 Forest-plot for subgroup comparison between self-rated and non-self-rated creativity measures.

subgroup were aggregated so that one mean effect size, along with a variance, was derived. The subgroups were based on the level of the self-efficacy measurement. Level 1 describes general-self-efficacy scales; level 2, creative self-efficacy; and level 3, creative self-efficacy, with a focus on a special domain. The correlations to creativity measures were compared based on those three groups: Against the proposed differences, all three levels revealed relative similar correlations (although the differences are of statistical significance). Level 1 (general) demonstrated $r = .40$, level 2 (creative self-efficacy [CSE]) $r = .36$, and level 3 (special CSE) $r = .48$ (results in Table 3, Figure 3, detailed plot in Appendix B4). Especially the forest plot revealed highly overlapping variances, something that decreases the importance of the statistical significant differences between the three levels. Unfortunately, the group sizes varied a lot: nine effect sizes were based on the first level, 41 on the second, and 10 on the third. Due to a minor magnitude of statistical significance and greatly overlapping variances, the hypothesis was considered to be not supported.

Exploratory Analysis

Additionally retrieved information from each study was tested regarding its influence on the relation between creativity and self-efficacy measures. There was no significant effect depending on the number of studies, the year of publication, nor the age of the sample. Further, there were no differences between the environment in which the study was conducted (universities, schools, working environment or mixed) with regard to the effect size of the association between creativity and self-efficacy. The country from which the data was collected brought significant differences in effect sizes. The type of creativity measurement (scales, verbal performance tests, figural performance tests) lead to differences between the effect size of creativity and self-efficacy with scales leading to the highest correlations of $r = .43$, followed by verbal tests with $r = .27$ and the smallest relation with figural tests with $r = .19$. The creativity aspect (person, product, process) also showed differences in effect sizes. The person measures correlated most strongly to creative self-efficacy with $r = .47$ and the process measures only weakly with $r = .27$. Product measures was in between with $r = .32$. Both questions were analyzed similarly to hypothesis IV. The results can be seen in

TABLE 3
Q-test for heterogeneity under random-effects model for subgroup-analysis between the three levels of self-efficacy measurement (ANOVA-table)

	r	*Q*	*df*	*p*
Level 1 (general)	.40	265.79	8	
Level 2 (CSE)	.36	1044.43	40	
Level 3 (special CSE)	.48	157.48	9	
Within		1467.70		
Between		40.18	2	<.0001
Total		11507.88		

Notes. *r* is the mean effect size for each subgroup; *Q* are the observed weighted sum of squares; *df* is the expected sum of squares; *p* the statistical significance of the dispersion.

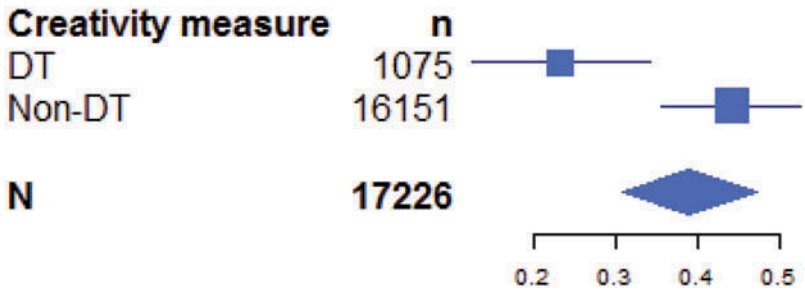

FIGURE 2 Forest-plot for subgroup comparison between DT and non-DT measures.

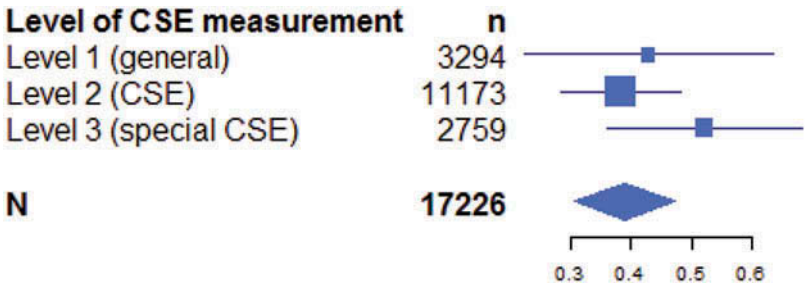

FIGURE 3 Forest-plot for subgroup comparison between the three measurement levels of CSE.

Table 4, as well as in Figures 4 and 5 (detailed plots in Appendices B5 and B6).

Publication Bias

A statistical analysis was done to estimate the potential influence of missing studies due to the tendency that usually only significant results get published (file-drawer problem; Rosenthal, 1979). Two more recent tests of publication bias have been applied, relying on the online App by Schönbrodt (2015) and on the *p*-curve application on the Internet (www.p-curve.com; Simonsohn, Simmons, & Nelson, 2015). First, the distribution of the significant *p*-values of all studies was analyzed (p-curve analysis; Simonsohn, Nelson, & Simmons, 2014; Simonsohn et al., 2015). Ideally, the *p*-curve should be right-skewed with more *p*s < .01 than between .01 and .02, or .04 and .05, for instance. This was the case with 90% of the significant *p*-values below .01, indicating strong evidential value with an observed power of .99. Next, the test of insufficient variance was applied (TIVA, Schimmack, 2014). The TIVA transforms all test statistics into *z*-scores and computes the variance of them. A variance < 1 can indicate publication bias. However, the distribution of the *Z*-values was large, variance = 2.05, indicating no bias (Schimmack, 2014).

Further, Orwin´s *fail-safe N* is used to assess the number of studies which are needed to nullify the effect found in the meta-analysis. A smallest effect that would still be of substantive importance is set at a correlation of .20. The calculated Orwin´s *N* was 50 (Borenstein et al., 2009), making it unlikely that there would be as many not-found studies as those that were included in this analysis. Hence, the overall effect was most probably not based on a biased sample.

TABLE 4
Q-test for heterogeneity under random-effects model for subgroup-analysis between the types and the aspects of creativity measures (ANOVA-table)

Exploratory analysis for the types of creativity measurements				
	r	*Q*	*df*	*p*
Items	.43	1197.78	47	
Verbal	.27	9.52	6	
Figural	.19	4.04	4	
Within		1211.34		
Between		296.54	2	<.0001
Total		11507.88		
Exploratory analysis for aspects of creativity measurements				
	r	*Q*	*df*	*p*
Person	.47	590.21	28	
Product	.32	743.96	22	
Process	.27	28.61	7	
Within		1362.79		
Between		145.09	2	<.0001
Total		11507.88		

Notes. *r* is the mean effect size for each subgroup; *Q* are the observed weighted sum of squares; *df* is the expected sum of squares; *p* the statistical significance of the dispersion.

DISCUSSION

The overall mean relation between creativity and creative self-efficacy was of medium size (*r* = .39), as postulated

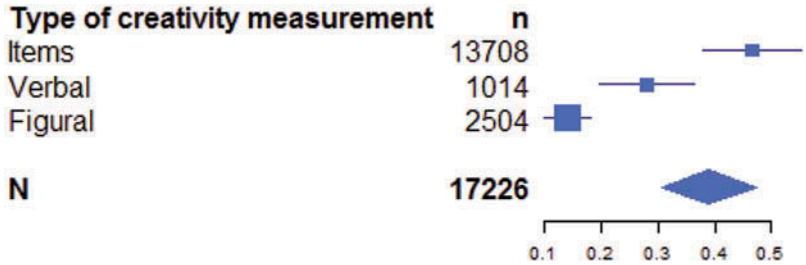

FIGURE 4 Forest-plot for subgroup comparison between the three measurement types of C.

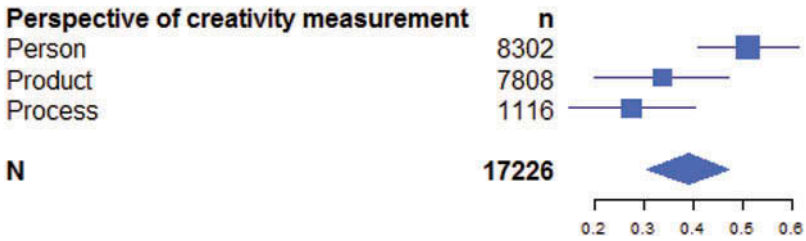

FIGURE 5 Forest-plot for subgroup comparison between the three aspects ("perspective") of creativity.

(hypothesis I). However, the measure of the *true* between study variance, I^2, demonstrated a great variety between the studies. An overall correlation with self-efficacy of roughly .40 is not trivial and indicates substantial relation between the two concepts. Creative behavior relies in some part on individuals' beliefs about their potential to perform creatively (Tierney & Farmer, 2002). The dispersion of effect sizes is at least partly linked to the use of different types of creativity measurements.

The results of hypotheses II and III suggest that DT tasks relate much less to the self-efficacy construct compared to self-rated creativity scales. It means that the ability for creative idea generation (creative process) does not, to a large extent, correspond to the individual's belief in his or her potential to act creatively. On the one hand, a small correlation between DT-scores and self-efficacy beliefs can be interpreted as an indication of a greater objectivity of the DT test as compared to scores for self-reported creativity. On the other hand, the result can be due to that scores for DT just constitute a small part of the full creative process. The mere generation of ideas and the ability to fulfill an actual creative accomplishment may not be equivalent. Several researchers have pointed out that DT is not creativity per se (Hennessey, 2003; Runco, 2010).

Because of overlapping variances, only a small variation between different self-efficacy measurements (hypothesis IV) was found. The range of effect sizes between the studies could not be explained by general or domain-specific levels of (creative) self-efficacy beliefs. Further research is needed to understand the differences between different levels of self-efficacy beliefs and this research area would especially benefit from a standardized usage of one or a few scales, so results can be compared more easily.

Further exploratory analyses showed significant results in favor of the tested hypotheses. Some variables did not moderate the relation between creativity and self-efficacy, for example, the variables *age* (children, university students, working adults) and *environment* (school, university, work, mixed). It could be assumed that these variables would matter, because data show that there are often differences between students and nonstudent subjects (based on a second-order meta-analysis, Peterson, 2001). However, the differences in the field of self-efficacy were not large enough to have a significant impact on the data. Perhaps one reason is that there were only a few studies with children as participants. This indicates that believing in oneself (self-efficacy) relates to creativity in the same way across different age groups and across different contexts. No sex differences were found in the data. This is in line with earlier research, because studies found that gender differences are generally small concerning measured creative performance (e.g. Kerr, 2009).

The *type*, as well as the *aspect*, of creativity measurement were the only variables that entailed differences concerning the relation between creativity measures and self-efficacy. Studies measuring creativity with questionnaires/scales showed stronger association (r = .43) between creativity and self-efficacy than when verbal tests of creativity (r = .27) were used. The use of figural tests of creativity brought only a very weak (nonsignificant) relation to the self-efficacy concept (r = .19). This again, as argued along with hypothesis III, may suggest that figural and verbal performance tests of creativity constitute more objective measures of actual creativity (be it process or product tests), as test scores are independent of subjective evaluations.

In the scale category, both self-assessed and expert/non-expert ratings were mixed. One may argue that expert/non-expert ratings would be more objective than self-ratings in most cases. However, in the present comparison, there is also more complexity as there is a great difference depending on who is doing the assessment (someone who knows the participants or not) and if there is a mean between many raters as in the consensual assessment technique (Amabile, 1982). Ratings with anonymous raters and those having multiple raters would increase the objectivity of the scores. In this investigation, not enough studies for each category of measures were available to do an interaction analyses between different other-rated measures. The relation between other-rated creativity and creative self-efficacy needs further investigations.

Some more clarifications were obtained by the analysis of the creativity aspects (person, product, process). It revealed that the creativity measurement involving the creative person demonstrated a high statistical relation to self-efficacy (r = .47). Measures of creative products (r = .32) and creative processes (r = .27) generated a smaller relation.

Overall, the result of the analysis creates a coherent picture: Creativity and self-efficacy beliefs are related when focusing on the creative individuals and their opinions about their creative skills. Switching focus to performance tests of creative products and creative processes, the relation to self-efficacy becomes weaker. This is in line with self-efficacy theory, which is, by definition, concerned with individuals' own evaluations of their potential. It therefore has no demand on 'objectivity'.

To this must be added that different self-report scales have also been found to have different qualities (Batey, 2007). Questionnaires asking for actual or past hobbies (Batey, 2007; Dollinger, 2011) and professional accomplishments (Carson et al., 2005) have been purported to be less influenced by social desirability. In our analysis, the distinction was not possible to make between self-report measures on personality or creative ability and those concerning specific activities or products as to their possibly different relation to self-efficacy. The number of studies of each type was too small.

Since this study demonstrates a meaningful difference between ways of measuring creativity, it seems advisable to split up the creativity concept into different parts. Self-assessed creative personality traits and self-assessed general creative ability may capture creative confidence and are more closely linked

to self-efficacy, whereas creativity as measured by performance tasks captures another side of creativity—in this sample of studies, only the process type measured by DT tasks was tested—and had a weak association to self-efficacy. More studies comparing the link between creative self-efficacy and DT tasks and other creative process types—such as combinatory ability, or restructuring ability (Antonietti & Iannello, 2008) are warranted to understand why creative process as measured with performance tasks is less available for individuals to accurately perceive in themselves or at least not related to inidividuals' efficacy-beliefs.

Limitations and Future Research

One problem with meta-analyses is that they depend on the quality of the empirical studies included in the analysis. Any bias on primary data level will have an influence on the main results. Especially a reporting bias toward significant positive results is common within research, but cannot be estimated or statistically accounted for (compare Sánchez-Meca & Marín-Martínez, 2010). For this analysis, primary data were selected from specific criteria, to ensure the best possible quality.

Most studies assessed creativity in general, so there were no possibilities for comparisons concerning specific domains, such as scientific and artistic creativity. Differentiating domains could explain some of the variance found within the present analysis.

Because a meta-analysis is a method to structure research findings, as well as exploring patterns in those, it is a useful tool to better understand a multifaceted research topic as creativity. More higher-level analysis should be welcomed, but of course this premises a certain amount of primary data on the same or at least similar variables. As Glăveanu (2014) criticized correctly, research findings are rarely replicated nor do they build on each other.

Furthermore, no primary data assessing high creative performers could be found. Researchers have suggested that there might be differences between creative laypeople and creative professionals (e.g. Beghetto et al., 2011), even if others have argued that the creative ability is not different (Runco, 2014). Future studies including individuals with socially recognized creative achievements could test whether the relation between their creative performance scores and self-efficacy beliefs differ from the result of this study. Recognized creative people might possibly have higher creative self-efficacy because of their actual success in a field and the link to performance tests might also be greater.

Because hypothesis IV did not reveal a clear pattern on the different levels of self-efficacy beliefs, studies are also needed that explicitly compare different measurement levels to reveal possible differences.

The debate goes on whether creativity should be better assessed as a domain-general or a domain-specific ability. Pretz and McCollum (2014) showed that there is an association between the belief that one has creative potential (self-efficacy) and the belief to be creative both on more domain-specific (self-rated fluency) and domain-general self-ratings (I'm creative). However, they found only links to the DT tests with the domain-specific self-evaluations (e.g., how well did I perform on a just taken fluency test). This indicates that the relation to self-efficacy may also be affected by domain-specificity.

Further criticism can be addressed to the research field itself. The articles included in this meta-analysis mostly assessed creativity via self-rated scales, not seldom with measures constructed for each study, sometimes with only one item. Although this is an economical and easy procedure, the construct validity is questionable; not the least considering that the present study showed high correlation with self-efficacy beliefs. More studies that use better validated and well-established creativity measurements are needed.

The results of this study revealed the need for researchers to precisely delineate what part of the creativity construct they are aiming at investigating. Otherwise relations to other constructs, such as creative self-efficacy in this case, might add confusion to the results.

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REFERENCES

Alicke, M. D., & Govorun, O. (2005). The better-than-average effect. *Self in Social Judgment*, *1*, 85–106.

Amabile, T. M. (1982). Social psychology of creativity: A consensual assessment technique. *Journal of Personality and Social Psychology*, *43*, 997–1013. doi:10.1037/0022-3514.43.5.997

*Animasahun, R. A. (2009). Psychodemographic predictors of school attendance behaviour among secondary school students in Osun State, Nigeria. *Social Sciences*, *4*, 662–672.

Antonietti, A., & Iannello, P. (2008). *Representing the mind: A collection of instruments to assess naïve psychological conceptions*. Milano, Italy: Polimetrica International Scientific Publisher.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.

Batey, M. (2007). *A psychometric investigation of everyday creativity*. London, UK: Department of psychology. University of London.

Batey, M., Furnham, A., & Safiullina, X. (2010). Intelligence, general knowledge and personality as predictors of creativity. *Learning and Individual Differences*, *20*, 532–535. doi:10.1016/j.lindif.2010.04.008

*Beghetto, R. A., & Baxter, J. A. (2012). Exploring student beliefs and understanding in elementary science and mathematics. *Journal of Research in Science Teaching*, *49*, 942–960. doi:10.1002/tea.v49.7

*Beghetto, R. A., Kaufman, J. C., & Baxter, J. (2011). Answering the unexpected questions: Exploring the relationship between students' creative self-efficacy and teacher ratings of creativity. *Psychology of Aesthetics, Creativity, and the Arts*, *5*, 342. doi:10.1037/a0022834

Boer, D., & Fischer, R. (2013). How and when do personal values guide our attitudes and sociality? Explaining cross-cultural variability in attitude–Value linkages. *Psychological Bulletin*, *139*, 1113–1147. doi:10.1037/a0031347

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2005). *Comprehensive meta-analysis version 2* (pp. 104). Englewood, NJ: Biostat.

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. Chichester, England: Wiley & Sons, Ltd.

*Carmeli, A., & Schaubroeck, J. (2007). The influence of leaders' and other referents' normative expectations on individual involvement in creative work. *Leadership Quarterly*, *18*, 35–48. doi:10.1016/j.leaqua.2006.11.001

Carson, S. H., Peterson, J. B., & Higgins, D. M. (2005). Reliability, validity, and factor structure of the creative achievement questionnaire. *Creativity Research Journal*, *17*, 37–50. doi:10.1207/s15326934crj1701_4

*Choi, J. N. (2004). Individual and contextual predictors of creative performance: The mediating role of psychological processes. *Creativity Research Journal*, *16*, 187–199. doi:10.1080/10400419.2004.9651452

*Chuang, C.-F., Shiu, S.-C., & Cheng, C.-J. (2010). The relation of college students' process of study and creativity: The mediating effect of creative self-efficacy. *World Academy of Science, Engineering and Technology*, *43*, 960–963.

*Dayan, M., Zacca, R., & Di Benedetto, A. (2013). An exploratory study of entrepreneurial creativity: Its antecedents and mediators in the context of UAE firms. *Creativity and Innovation Management*, *22*, 223–240. doi:10.1111/caim.2013.22.issue-3

*De Acedo Lizarraga, M. L. S., De Acedo Baquedano, M. T. S., & Closas, A. H. (2014). An explanatory model regarding the relationships between psychological traits and creativity. *Anales De Psicología*, *30*, 356–364.

*Diliello, T. C., Houghton, J. D., & Dawley, D. (2011). Narrowing the creativity gap: The moderating effects of perceived support for creativity. *The Journal of Psychology: Interdisciplinary and Applied*, *145*, 151–172. doi:10.1080/00223980.2010.548412

Dollinger, S. J. (2011). "Standardized minds" or individuality? Admissions tests and creativity revisited. *Psychology of Aesthetics Creativity and the Arts*, *5*, 329–341. doi:10.1037/a0023659

Dollinger, S. J., Urban, K. K., & James, T. A. (2004). Creativity and openness: Further validation of two creative product measures. *Creativity Research Journal*, *16*, 35–47. doi:10.1207/s15326934crj1601_4

Duncker, K., & Lees, L. S. (1945). On problem-solving. *Psychological Monographs*, *58*(5), i–113. doi:10.1037/h0093599

Ekvall, G. (1990). *Work climate. Manual form A*. Stockholm, Sweden: GE Organizational Psychology.

*Farmer, S. M., Tierney, P., & Beldona, S. (2007). *The 'typical' creator: A creator profile comparison between U.S. and Indian High–tech employees*. Unpublished manuscript, School of Business, Wichita State University, Wichita, KS.

Farmer, S. M., Tierney, P., & Kung-McIntyre, K. (2003). Employee creativity in taiwan: An application of role identity theory. *Academy of Management Journal*, *46*, 618–630. doi:10.2307/30040653

Furnham, A., Batey, M., Anand, K., & Manfield, J. (2008). Personality, hypomania, intelligence and creativity. *Personality and Individual Differences*, *44*, 1060–1069. doi:10.1016/j.paid.2007.10.035

Gajda, A., Karwowski, M., & Beghetto, R. A. (2017). Creativity and academic achievement: A meta-analysis. *Journal of Educational Psychology*, *109*, 269. doi:10.1037/edu0000133

Glăveanu, V. P. (2014). The psychology of creativity: A critical reading. *Creativity: Theories–Research-Applications*, *1*, 0–32. doi:10.15290/ctra.2014.01.01.02

*Gong, Y., Huang, J.-C., & Farh, J.-L. (2009). Employee learning orientation, transformational leadership, and employee creativity: The mediating role of employee creative self-efficacy. *Academy of Management Journal*, *52*, 765–778. doi:10.5465/AMJ.2009.43670890

Gough, H. G. (1979). A creative personality scale for the adjective check list. *Journal of Personality and Social Psychology*, *37*, 1398–1405. doi:10.1037/0022-3514.37.8.1398

*Graham, J. D. B. (2011). *Elements of human effectiveness: Intelligences, traits, and abilities that lead to success and fulfillment in life* (Doctoral dissertation). Retrieved from ProQuest Dissertations Publishing, 3477827.

Hennessey, B. A. (2003). The social psychology of creativity. *Scandinavian Journal of Educational Research*, *47*, 253–271. doi:10.1080/00313830308601

Hoff, E., Carlsson, I., & Rasulzada, F. (2014). Konsten att mäta kreativitet [The art of measuring creativity]. In: E. Brodin, I. Carlsson, E. Hoff, & F. Rasulzada (Eds.), *Kreativitet: Teori och praktik ur psykologiska perspektiv [Creativity: Theory and practice from psychological perspectives]* (pp. 543–573). Stockholm, Sweden: Liber.

*Hong, E., Peng, Y., & O'Neil, H. F. J. (2014). Activities and accomplishments in various domains: Relationships with creative personality and creative motivation in adolescence. *Roeper Review: A Journal on Gifted Education*, *36*, 92–103. doi:10.1080/02783193.2014.884199

*Hsu, M. L. A., Hou, S.-T., & Fan, H.-L. (2011). Creative self-efficacy and innovative behavior in a service setting: Optimism as a moderator. *Journal of Creative Behavior*, *45*, 258–272. doi:10.1002/j.2162-6057.2011.tb01430.x

*Jaussi, K. S., Randel, A. E., & Dionne, S. D. (2007). I am, I think I can, and I do: The role of personal identity, self-efficacy, and cross-application of experiences in creativity at work. *Creativity Research Journal*, *19*, 247–258. doi:10.1080/10400410701397339

*Karwowski, M. (2011). It doesn't hurt to ask…But sometimes it hurts to believe: Polish students' creative self-efficacy and its predictors. *Psychology of Aesthetics, Creativity, and the Arts*, *5*, 154–164. doi:10.1037/a0021427

Karwowski, M. (2012). Did curiosity kill the cat? Relationship between trait curiosity, creative self-efficacy and creative personal identity. *Europe's Journal of Psychology*, *8*, 547–558. doi:10.5964/ejop.v8i4.513

Karwowski, M., & Lebuda, I. (2016). The big five, the huge two, and creative self-beliefs: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, *10*, 214–232. doi:10.1037/aca0000035

*Karwowski, M., Lebuda, I., & Wiśniewska, E. (2012). Measurement of creative self-efficacy and creative role-identity. *High Ability Studies*, *22*, 291–231.

Kerr, B. (Ed.). (2009). *Encyclopedia of giftedness, creativity, and talent*. London, UK: Sage.

Lemons, G. (2010). Bar drinks, rugas, and gay pride parades: Is creative behavior a function of creative self-efficacy? *Creativity Research Journal*, *22*, 151–161. doi:10.1080/10400419.2010.481502

*Li, C.-H., & Wu, -J.-J. (2011). The structural relationships between optimism and innovative behavior: Understanding potential antecedents and mediating effects. *Creativity Research Journal*, *23*, 119–128. doi:10.1080/10400419.2011.571184

*Liao, H., Liu, D., & Loi, R. (2010). Looking at both sides of the social exchange coin: A social cognitive perspective on the joint effects of relationship quality and differentiation on creativity. *Academy of Management Journal*, *53*, 1090–1109. doi:10.5465/AMJ.2010.54533207

Lumley, T. (2015). Package "rmeta". *Version*, *2.16*.

*Ma, Y., Cheng, W., Ribbens, B. A., & Zhou, J. (2013). Linking ethical leadership to employee creativity: Knowledge sharing and self efficacy as mediators. *Social Behavior and Personality*, *41*, 1409–1419. doi:10.2224/sbp.2013.41.9.1409

MacGregor, J. N., & Cunningham, J. B. (2008). Rebus puzzles as insight problems. *Behavior Research Methods*, *40*, 263–268. doi:10.3758/brm.40.1.263

*Malik, M. A. R., Butt, A. N., & Choi, J. N. (2014). Rewards and employee creative performance: Moderating effects of creative self-efficacy, reward importance, and locus of control. *Journal of Organizational Behavior*, *36*, 59–74. doi:10.1002/job.1943

*Mathisen, G. E., & Bronnick, K. S. (2009). Creative self-efficacy: An intervention study. *International Journal of Educational Research*, *48*, 21–29. doi:10.1016/j.ijer.2009.02.009

Mednick, S. (1962). The associative basis of the creative process. *Psychological Review*, *69*, 220–232. doi:10.1037/h0048850

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G., & The PRISMA Group. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*, *6*(7). doi:10.1371/journal.pmed.1000097

Peterson, R. A. (2001). On the use of college students in social science research: Insights from a second-order meta-analysis. *Journal of Consumer Research*, *28*, 450–461. doi:10.1086/323732

Pettigrew, T. F., & Tropp, L. R. (2006). A meta-analytic test of intergroup contact theory. *Journal of Personality and Social Psychology*, *90*, 751. doi:10.1037/0022-3514.90.5.751

*Phelan, S. G. (2001). Developing creative competence at work: The reciprocal effects of creative thinking, self-efficacy and organizational culture on creative performance. *Dissertation Abstracts International:20Section B: The Sciences and Engineering*, *62(2-B)*, 1059.

*Prabhu, V., Sutton, C., & Sauser, W. (2008). Creativity and certain personality traits: Understanding the mediating effect of intrinsic motivation. *Creativity Research Journal*, *20*, 53–66. doi:10.1080/10400410701841955

*Pretz, J. E., & McCollum, V. A. (2014). Self-perceptions of creativity do not always reflect actual creative performance. *Psychology of Aesthetics, Creativity, and the Arts*, *8*, 227. doi:10.1037/a0035597

*Rego, A., Sousa, F., Marques, C., & Cunha, M. P. E. (2011). Retail employees' self-efficacy and hope predicting their positive affect and creativity. *European Journal of Work and Organizational Psychology*, *21*, 923–945. doi:10.1080/1359432X.2011.610891

*Reiter-Palmon, R., Robinson-Morral, E. J., Kaufman, J. C., & Santo, J. B. (2012). Evaluation of self-perceptions of creativity: Is it a useful criterion? *Creativity Research Journal*, *24*, 107–114. doi:10.1080/10400419.2012.676980

Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan*, *42*, 305–310.

*Richter, A. W., Hirst, G., Van Knippenberg, D., & Baer, M. (2012). Creative self-efficacy and individual creativity in team contexts: Cross-level interactions with team informational resources. *Journal of Applied Psychology*, *97*, 1282–1290. doi:10.1037/a0029359

*Robbins, T. L., & Kegley, K. (2010). Playing with thinkertoys to build creative abilities through online instruction. *Thinking Skills and Creativity*, *5*, 40–48. doi:10.1016/j.tsc.2009.07.001

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*, 638–641. doi:10.1037/0033-2909.86.3.638

Runco, M. A. (2010). Divergent t.hinking, creativity and ideation. In: J. C. Kaufman, & R. J. Sternberg (Eds), *The Cambridge handbook of creativity* (pp. 413–446). New York, NY: Cambridge University Press.

Runco, M. A. (2014). "Big C, Little c" creativity as a false dichotomy: Reality is not categorical. *Creativity Research Journal*, *26*, 131–132. doi:10.1080/10400419.2014.873676

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*, 92–96. doi:10.1080/10400419.2012.650092

Runco, M. A., Plucker, J. A., & Lim, W. (2001). Development and psychometric integrity of a measure of ideational behavior. *Creativity Research Journal*, *13*, 393–400. doi:10.1207/s15326934crj1334_16

*Salanova, M., Lorente, L., & Martínez, I. M. (2012). The dark and bright sides of self-efficacy in predicting learning, innovative and risky performances. *Spanish Journal of Psychology*, *15*, 1123–1132. doi:10.5209/rev_SJOP.2012.v15.n3.39402

Sánchez-Meca, J., & Marín-Martínez, F. (2010). Meta-analysis. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International Encyclopedia of Education* (3rd ed.), vol. 7 (pp. 274–282). Oxford, UK: Elsevier.

Schimmack, U. (2014). *The test of insufficient variance (TIVA): A new tool for the detection of questionable research practices*. Retrieved from https://replicationindex.wordpress.com/tag/test-of-insufficient-variance/

Schönbrodt, F. D. (2015). *p-checker: One-for-all p-value analyzer*. Retrieved from http://shinyapps.org/apps/p-checker/

*Seo, Y. W., Chae, S. W., & Lee, K. C. (2015). The impact of absorptive capacity, exploration, and exploitation on individual creativity: Moderating effect of subjective well-being. *Computers in Human Behavior*, *42*, 68–82. doi:10.1016/j.chb.2014.03.031

*Shin, S. J., Kim, T.-Y., Lee, J.-Y., & Bian, L. (2012). Cognitive team diversity and individual team member creativity: A cross-level interaction. *Academy of Management Journal*, *55*, 197–212. doi:10.5465/amj.2010.0270

*Simmons, A. L., Payne, S. C., & Pariyothorn, M. M. (2014). The role of means efficacy when predicting creative performance. *Creativity Research Journal*, *26*, 53–61. doi:10.1080/10400419.2014.873667

Simonsohn, U., Nelson, L. D., & Simmons, J. P. (2014). *p*-curve and effect size correcting for publication bias using only significant results. *Perspectives on Psychological Science*, *9*, 666–681. doi:10.1177/1745691614553988

Simonsohn, U., Simmons, J. P., & Nelson, L. D. (2015). Better *P*-curves: Making *P*-curve analysis more robust to errors, fraud, and ambitious *P*-hacking, a reply to Ulrich and Miller. *Journal of Experimental Psychology: General*, *144*, 1146–1152. doi:10.1037/xge0000104

*Tamannaeifar, M. R., & Motaghedifard, M. (2014). Subjective well-being and its sub-scales among students: The study of role of creativity and self-efficacy. *Thinking Skills and Creativity*, *12*, 37–42. doi:10.1016/j.tsc.2013.12.003

*Tierney, P., & Farmer, S. M. (2002). Creative self-efficacy: Its potential antecedents and relationship to creative performance. *Academy of Management Journal*, *45*, 1137–1148. doi:10.2307/3069429

*Tierney, P., & Farmer, S. M. (2004). The Pygmalion process and employee creativity. *Journal of Management*, *30*, 413–432. doi:10.1016/j.jm.2002.12.001

Tierney, P., & Farmer, S. M. (2011). Creative self-efficacy development and creative performance over time. *Journal of Applied Psychology*, *96*, 277–293. doi:10.1037/a0020952

Torrance, E. P. (1965). *Rewarding creative behavior*. Englewoods Cliffs, NJ: Prentice-Hall.

Urban, K. K. (2004). Assessing creativity: The test for creative thinking - drawing production (TCT-DP) the concept, application, evaluation, and international studies. *Psychology Science*, *46*, 387.

*Vinarski-Peretz, H., Binyamin, G., & Carmeli, A. (2011). Subjective relational experiences and employee innovative behaviors in the workplace. *Journal of Vocational Behavior*, *78*, 290–304. doi:10.1016/j.jvb.2010.09.005

*Wang, C.-J., Tsai, H.-T., & Tsai, M.-T. (2014). Linking transformational leadership and employee creativity in the hospitality industry: The influences of creative role identity, creative self-efficacy, and job complexity. *Tourism Management*, *40*, 79–89. doi:10.1016/j.tourman.2013.05.008

*Wang, S., Zhang, X., & Martocchio, J. (2011). Thinking outside of the box when the box is missing: Role ambiguity and its linkage to creativity. *Creativity Research Journal*, *23*, 211–221. doi:10.1080/10400419.2011.595661

*Zhang, X., & Zhou, J. (2014). Empowering leadership, uncertainty avoidance, trust, and employee creativity: Interaction effects and a mediating mechanism. *Organizational Behavior and Human Decision Processes*, *124*, 150–164. doi:10.1016/j.obhdp.2014.02.002

Marked with * are those studies which are included in the meta analysis.

APPENDIX A

TABLE A1.
Characteristics of Studies Included in the Meta-analysis.

Nr	Author	Year	N	r_{CSE_C}	Environment	C measurement	C measure type	C measure aspect	CSE level	Mean age (SD)	Percentage females	Country
1	Animasahun	2009	626	.74	university	self-report	scale	person	1		38.10	Nigeria
2	Beghetto, Kaufmann, Baxter	2011	595	.18	school	non-expert ratings	scale	product	2	10.05	51.30	USA
			297	.22	school	non-expert ratings	scale	product	2	9.93	47.40	
			288	.26	school	non-expert ratings	scale	product	2	9.93	47.40	
3	Beghetto, Baxter	2012	276	.50	school	self-report	scale	person	1	9.44	46.40	USA
			276	.61	school	self-report	scale	person	1	9.44	46.4	
4	Carmeli, Schaubroeck	2007	140	.42	work	self-report	scale	product	2	28.30 (6.50)	56.10	Israel
5	Choi	2004	331	.35	university	non-expert ratings	scale	product	2	19.80 (2.10)	51.60	USA
			331	.43	university	self-report	scale	person	1			
6	Chuang, Shiu, Cheng	2010	60	.79	university	self-report	scale	person	1			Taiwan
7	Dayan, Zacca, Di Benedetto	2013	119	.35	work	self-report	scale	product	2			United Arab Emirates
8	Diliello, Houghton, Dawley	2011	674	.28	work	self-report	scale	person	1	46.00		USA
9	Farmer, Tierney, Beldona	2007	191	.27	work	non-expert ratings	scale	person	1			USA/India
			102	.30	work	non-expert ratings	scale	person	1			
10	Gong, Huang, Farh	2009	200	.24	work	non-expert ratings	scale	person	1	36.94 (10.04)	41.00	China
11	Graham	2011	88	.06	work	divergent thinking	figural	product	2	45.89 (8.76)	25.00	USA
			102	-.04	university	divergent thinking	figural	product	2		53.90	
12	Hong, Peng, O´Neil	2014	439	.10	school	self-report	scale	product	2	15.50	49.89	China
13	Hsu, Hou, Fan	2011	120	.42	work	self-report	scale	product	2		100.00	Taiwan
14	Jaussi, Randel, Dionne	2007	179	.15	work	non-expert ratings	scale	person	1	40.00	27.00	USA
15	Karwowski	2011	1878	.15	school	association, combination	figural	product	2	16.80 (1.20)	49.70	Poland
16	Karwowski, Lebuda, Wisniewska	2012	385	.15	school	association, combination	figural	product	2	15.20 (2.20)	49.00	Poland
			385	.55	school	self-report	scale	person	1			
			115	.33	university	divergent thinking	verbal	process	3	20.10 (1.30)	89.00	
17	Li, Wu	2011	970	.78	university	self-report	scale	product	2	20.75 (1.64)	53.20	Taiwan
18	Liao, Liu, Loi	2010	828	.32	work	non-expert ratings	open	product	2	38.28 (7.85)		China
19	Lizarraga, Baquedano, Closas	2014	180	.40	university	divergent thinking	verbal	product	2	21.11 (4.48)	75.56	Spain
20	Ma, Cheng, Ribbens, Zhou	2013	309	.61	work	self-report	scale	person	1	32.13 (6.53)	64.40	China
21	Mathisen, Bronnick	2009	94	.28	mixed	divergent thinking	verbal	product	2	36.80	14.00	Norway
22	Malik, Butt, Choi	2014	181	.27	work	self-report	scale	process	3	27.10 (7.98)	62.05	Pakistan
23	Phelan	2001	105	.64	work	self-report	scale	person	1	41.94	64.80	USA
			103	.70	work	self-report	scale	person	1	41.75	77.80	
24	Prabhu, Sutton, Sauser	2008	124	.30	university	self-report	scale	person	1	21.70 (1.70)	42.00	USA
25	Pretz, McCollum	2014	90	-.12	university	non-expert ratings	open	process	3	21.46 (0.52)	54.90	USA
			90	.20	university	divergent thinking	verbal	process	3			
			90	.17	university	association, combination	verbal	product	2			
			90	.08	university	association, combination	verbal	product	2			

			90	.47	university	self-report	scale	product	1			
			90	.39	university	self-report	scale	process	3			
			90	.36	university	self-report	scale	product	2			
			90	.51	university	self-report	scale	product	2			
26	Rego, Sousa, Marques, Cunha	2011	507	.65	work	non-expert ratings	scale	person	1	27.10 (3.90)	65.30	Portugal
27	Reiter-Palmon, Robinson-Morral, Kaufman, Santo	2012	548	.61	university	self-report	scale	person	1	22.94 (6.05)	81.60	USA
28	Richter, Hirst, van Knippenberg, Baer	2012	176	.03	work	non-expert ratings	scale	person	1		39.00	International
29	Robbins, Kegley	2010	51	.15	university	divergent thinking	figural	process	3	19.76	65.00	USA
30	Salanova, Lorente, Martínez	2012	165	.76	university	self-report	scale	product	2		84.00	Spain
31	Seo, Chae, Lee	2015	706	.67	work	self-report	scale	person	1	34.50	17.40	Korea
32	Shin, Kim, Lee, Bian	2012	316	.16	work	self-report	scale	person	1	31.70	34.20	China
33	Simmons, Payne, Pariyothorn	2014	124	.06	university	non-expert ratings	scale	product	2	23.00 (5.10)	36.00	USA
34	Tamannaeifar, Motaghedifard	2014	355	.34	university	self-report	scale	person	1	23.78	49.60	Iran
			355	.31	university	divergent thinking	verbal	process	3			
35	Tan, Majid	2011	100	.60	work	self-report	scale	person	1	34.20	75.00	Singapore
			100	.68	work	self-report	scale	person	1			
36	Tierney, Farmer	2002	502	.17	work	non-expert ratings	scale	person	1			USA
			104	.24	work	non-expert ratings	scale	person	1			
37	Tierney, Farmer	2004	140	.29	work	non-expert ratings	scale	person	1			USA
38	Vinarski-Peretz, Binyamin, Carmeli	2011	218	.57	work	self-report	scale	product	2	37.66 (11.59)	49.00	Israel
39	Wang, Zhang, Martocchio	2011	231	.47	university	non-expert ratings	scale	process	3	24.17 (3.17)	56.30	USA
40	Wang, Tsai, Tsai	2014	395	.30	work	non-expert ratings	scale	person	1			Taiwan
41	Zhang, Zhou	2014	322	.61	work	non-expert ratings	scale	person	1	33.66 (6.60)	30.10	China

Notes: CSE level 1 = general-self-efficacy scales, CSE level 2 = creative self-efficacy scales, CSE level 3 = creative self-efficacy with a focus on a special domain.

APPENDIX B

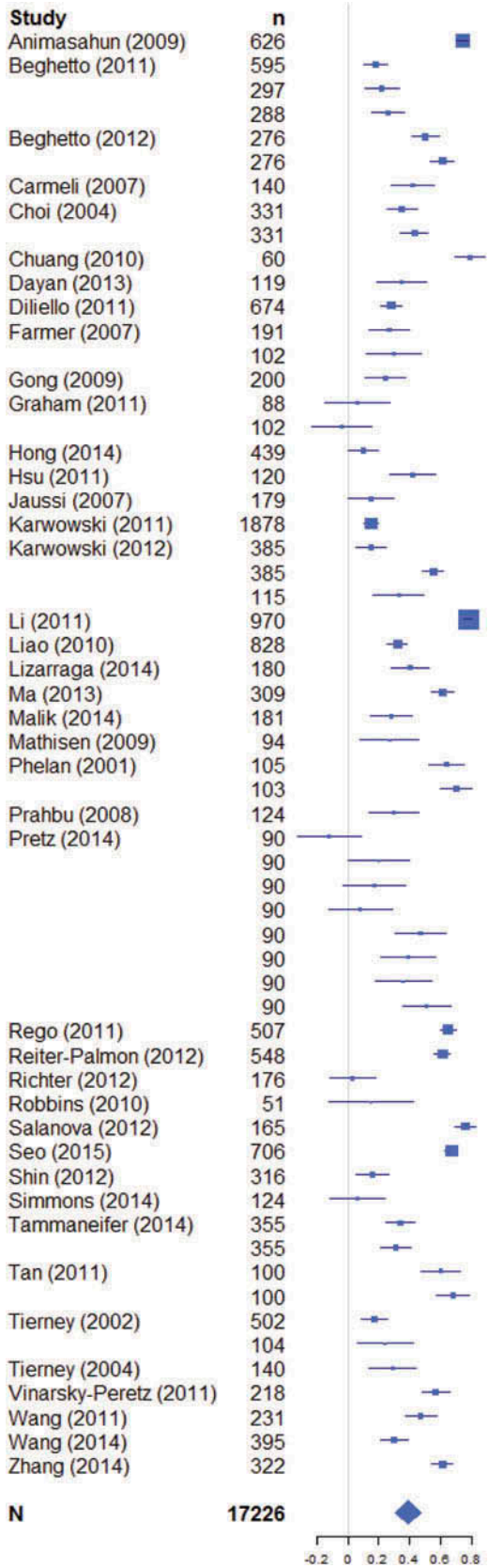

FIGURE B1. Forest plot showing studies reported effect sizes in relation to each other and overall mean effect size.

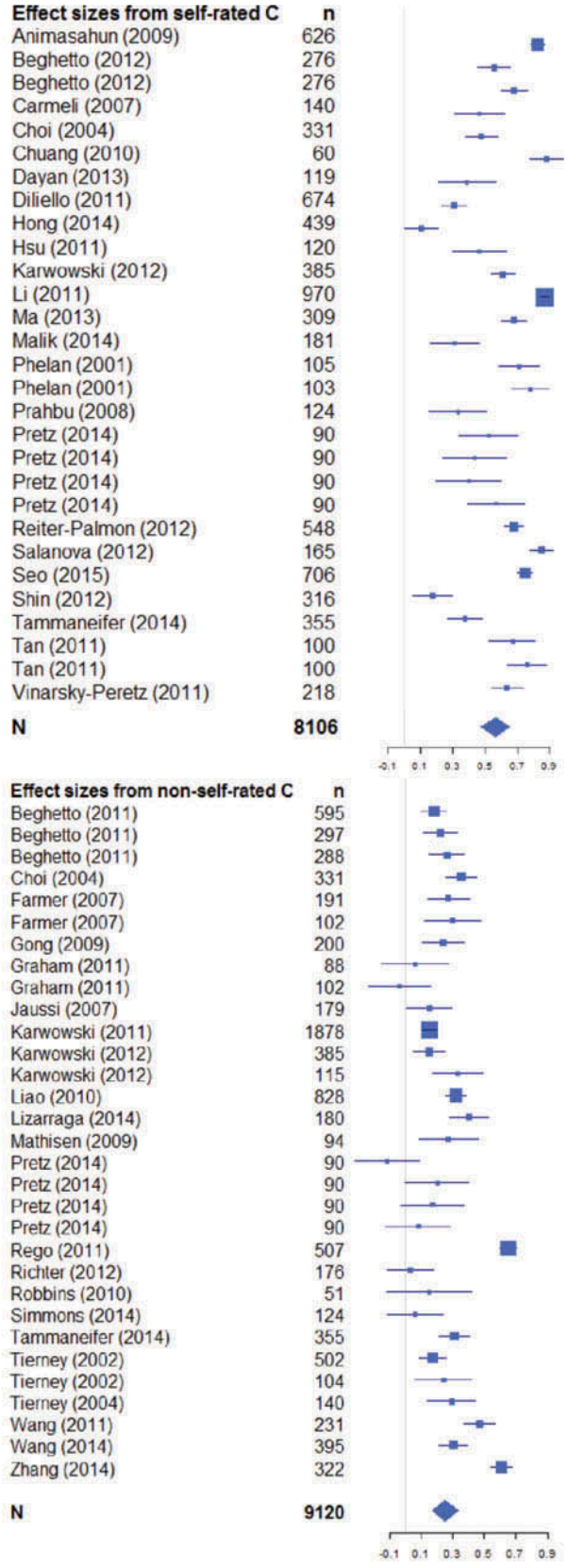

FIGURE B2. Forest-plot for subgroup comparison between self-rated C and non-self-rated C with all effect sizes.

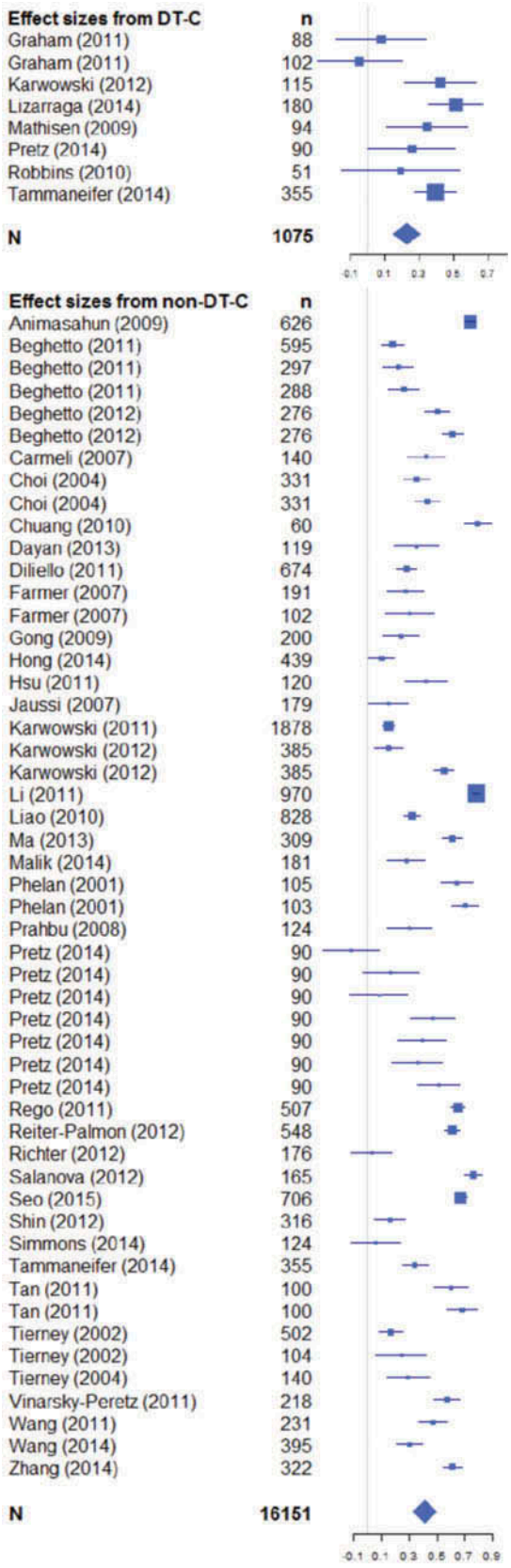

FIGURE B3. Forest-plot for subgroup comparison between DT- C and non-DT- C with all effect sizes.

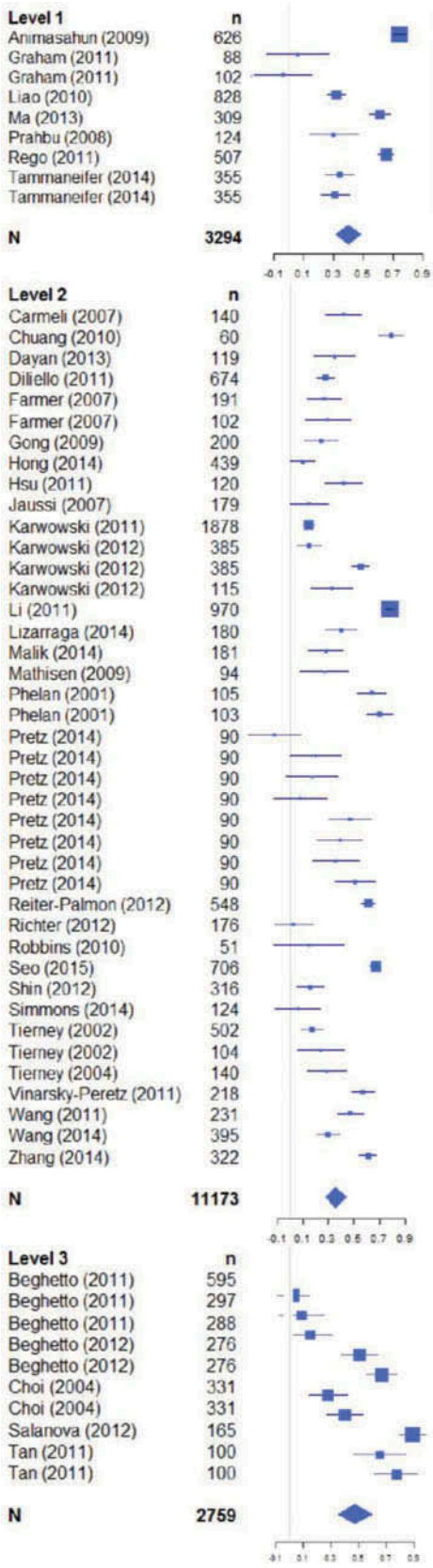

FIGURE B4. Forest-plot for subgroup comparison between the three measurement levels of CSE with all effect sizes.

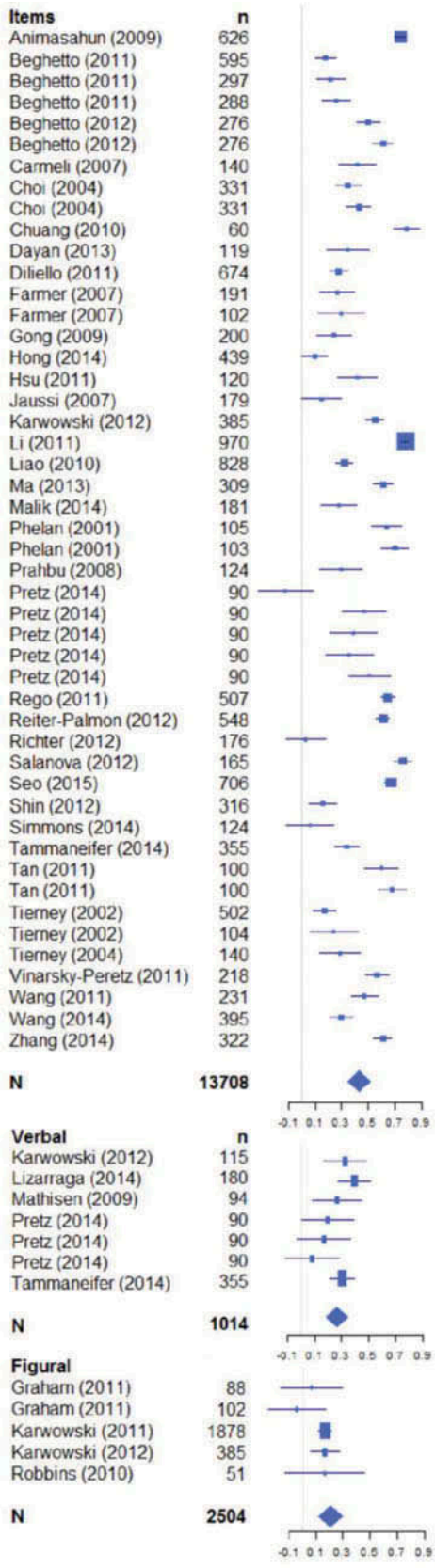

FIGURE B5. Forest-plot for subgroup comparison between the three measurement types of creativity for all effect sizes.

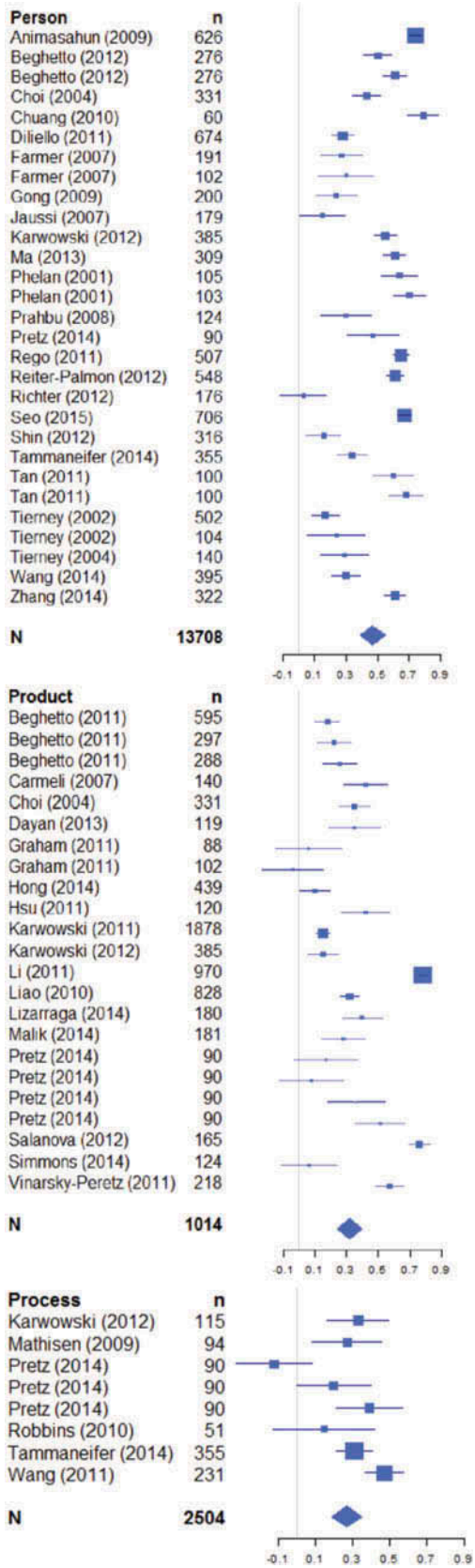

FIGURE B6. Forest-plot for subgroup comparison between three aspects of creativity for all effect sizes.