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Metacognition as a Moderator of Creative Ideation and Creative Production

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Recent theoretical work has called for exploration of the moderating effects of cognitive factors on the relationship between creative ideation and creative production. The Cognitive-Creative Sifting model suggests skills in processing and transforming information influence the association. This study used the Runco Ideational Behavior Scale, Metacognitive Awareness Inventory, and Creative Behavior Inventory to test the moderating effect. Medium to large moderator effects ($f^2 = .015$ to $f^2 = .041$) were observed across previous theoretically proposed aspects of metacognition. A large, statistically significant moderator effect was observed for overall metacognition ($f^2 = .031$). Observed differences across subcomponents of metacognition paralleled theoretical connections between metacognition and creativity. Further studies are suggested using more diverse creativity measures, as well as tests for other cognitive sifters. Implications for educational practice, particularly regarding the creatively gifted, are offered.

Research related to creativity assessment presents a complex problem. Issues related to definitions of creativity and persistent misguided beliefs among those on the periphery of creativity research generate an environment that may prevent the field from reaching its potential (Plucker, Beghetto, & Dow, 2004). In addition to the problems of status quo definitions and creativity myths that hinder research (see Sawyer, 2012), those in the field tend to doggedly focus on only two primary forms of assessment: (a) measuring levels of divergent thinking or creative ideation or (b) the assessment of creative products quantitatively or qualitatively (Author, in press). The chasm between ideas and products has remained largely unexplored as analyses in the research literature have tended to focus on finding the best means of assessing potential on one side or assessing outcomes on the other.

Cognitive processes occurring between the generation of an idea and manifestation of a product hold importance in the study of creativity and ought to be explored. The Cognitive-Creative Sifting model (see Figure 1) recently articulated this view and offered metacognition as one such cognitive process to be studied (Author, in press). This article is designed to shed light on the appropriateness of the approach by investigating the interaction of metacognition levels and creative ideation on levels of creative production. It should add color and perspective to the extensive research on the relationship between intelligence and creativity (see Kim, 2008, for a meta-analysis) and the growing research on creativity as a developmental process that attempts to relate divergent and convergent aspects of the construct (Sawyer, 2003).

The balance and interplay of accommodation and assimilation parallels the relationship between divergent and convergent thinking processes in creativity. Additionally, both suggest the importance of individual interests given the research-based link between intrinsic motivation and high levels of creativity (Runco, 1996). Eysenck (1993) and Cropley (1999) framed the divergent–convergent interactions as important to conceptualizations of creativity. More recently, Kaufman and Beghetto (2013) pointed out the importance of balance in a practical sense to maximizing creative development. This development is a personalized endeavor. Individuals could have, for instance, the same capacity to transform information, but may have different ends in

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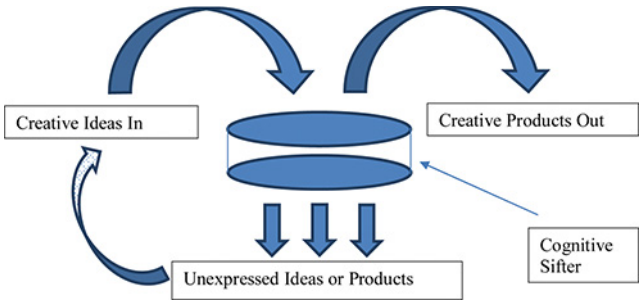

FIGURE 1 Cognitive-Creative Sifting Model.

mind, based on perceived skill level or simple personal preference. These, too, are processes suggested by the Cognitive-Creative Sifting model and are of a higher-order, reflective nature. As such, metacognition deserves consideration in the evaluation of creative development.

ASSESSING CREATIVITY

Typically, studies in the field of creativity have focused on the effects of variables such as divergent thinking or the quantity/quality of creative production. Table 1 provides a sampling of typical creativity assessments. The place of these assessments relative to the Cognitive-Creative Sifting model is included. Richer and more telling results may come from examining interaction and mediation effects involved when considering evaluation (metacognitive) skills (Runco, 2003b). Some authors suggest that skills in the processing of information may even be better outright predictors of creativity (Bachelor & Michael, 1991; Guilford, 1983; Subotnik, 1988).

Although many call for strict standard standards when evaluating creativity (e.g., Mumford, 2003), others have suggested that simply taking steps to maximize the objectivity in one's measurements is most appropriate (Runco, 2003a, 2003b). Taking the more narrow leads one to studies that end up focused on only small segments of the population—those high in creative achievement (Plucker et al., 2004). Taking a broader view that accounts for more intervening factors and generates a more evenly distributed view of creative potential across populations, may be more appropriate. Beghetto and Plucker (2007) argued that this more normal distribution would, among other things, allow studies in more diverse populations and more complex investigations across disciplines.

Most people demonstrate mundane and everyday creativity to some extent (Runco, 2003b). Evaluating everyday creativity ought to focus on the moment-to-moment interpretations that lead individuals to creative ideas (Runco, 1996). If one takes this view, the need to investigate the link between intrapersonal and interpersonal expression should be stressed, but must consider the distinctions during creativity assessment, partly as a means of discriminant validity (Kaufman & Beghetto, 2009; Runco, 2003b). In short, measures of creative potential (ideation) ought to be distinct from the evaluation of creative products and researchers ought to consider the role of internal processing as a moderator of processes at each end of the cognitive sifter.

METACOGNITION IN CREATIVITY

Although previous portions of this review have alluded to the potential connections between creativity and metacognition, more explicit associations can be made. To begin with, a framing of metacognition as a construct serves this end: "Metacognitive knowledge . . . can can lead you to select, evaluate, revise, and abandon

TABLE 1
Types of Creativity Assessment and Relation to Cognitive-Creative Sifting Model

Assessment (Example Reference)	*Connection to Present Work*
Alternative Uses Test (Guilford, 1967)	Test of divergent production; "CII"
Consensual Assessment Technique (Amabile, 1982)	External rating of "CPO"
Creative Achievement Questionnaire (Carson, Peterson, & Higgins, 2005)	Self-report of "CPO"
Creative Behavior Inventory (Hocevar, 1979)	Self-report of "CPO"
Creative Functioning Test (Smith & Carlsson, 1987)	Task completed; focus on flexibility, and novel responses; "CII" focus
Creative Personality Scale (Gough, 1979)	Self-report of adjectives describing personality; internal/unseen focus; perhaps related to "CS"
Remote Associations Test (Mednick, 1962)	Task completed; requires knowledge/intuition; related to "CS" but not metacognitive
Runco Ideational Behavior Scale (Runco et al., 2001)	Self-report of "CII"
Torrance Test of Creative Thinking (Torrance, 1974)	Divergent thinking test; "CII"
Wallach-Kogan Creativity Tests (Wallach & Kogan, 1965)	Divergent thinking test; "CII"

Note: "CII" = Creative Ideas In; "CPO" = Creative Products Out; "CS" = Cognitive Sifter.

cognitive tasks, goals, and strategies in light of their relationships, with one another and with your own abilities and interests with respect to that enterprise'' (Flavell, 1979, p. 908).

John Flavell is the most prominent theoretician in the field of conceptualizing metacognition. His work, dating back over 30 years, remains the standard to which other theories are tethered. In his view, metacognition relates to four interconnected issues: metacognitive knowledge, metacognitive experiences, goals/tasks, and actions/strategies (Flavell, 1979).

Given the interconnected nature of the underlying elements and the interest of clarity of explanation here, one can focus on a further breakdown of metacognitive knowledge Flavell employed to make the applications to Cognitive-Creative Sifting model. Flavell subdivided metacognitive knowledge into three areas: knowledge of persons (either intrapersonal or interpersonal), knowledge of task, and knowledge of strategies. The things that a person can know/believe ''about the nature of yourself and other people as cognitive processors'' constitutes knowledge of persons (Flavell, 1979, p. 907). In a cognitive-creative sifting framework, this relates to abilities in valuing potential creative options either to oneself or to others. It can be seen as related to the usefulness component (as a measure of quality) present in many contemporary definitions of creativity. Task knowledge involves a focus on specific individual undertakings and consideration of such tasks' place on a series of continua such as ''abundant or meager, familiar or unfamiliar, redundant or densely packed, well or poorly organized'' (p. 907). It is at this level of thoughtfulness that an individual conceives a given (creative) task's place in the individual's own understanding. Most certainly, this is an internal evaluation going on inside the sifter. Individuals with different insights into the continua (and different ability to make subtle distinctions regarding value) are likely to take actions seen as more creative.

In addition to an awareness of self and other's core abilities (persons) and consideration of values across multiple criteria (tasks), the final of the three subcategories of metacognitive knowledge relates to the ability to apply these other types of knowledge to affect change—knowledge of strategies. An individual may have to use all these types of metacognitive knowledge in a single situation. Thus, this interplay is potentially always occurring. The practical implications for creative tasks have been largely underresearched. Consider a one-word change of *cognitive* to *creative* in the earlier Flavell quote. Postchange, it still makes intuitive and logical sense.

More broadly, one's reasoning ability plays a practical role in creativity development (Runco, 2006). Although some studies have explicitly connected reasoning and creativity (e.g., Niu, Zhang, & Yang, 2007), Fasko (2006) pointed out that such work is scarce. Links between (the need for) creativity and learning situations become apparent when seeking to teach students the difference between rote memorization and deeper conceptual understandings (Beghetto & Plucker, 2006). Learning processes give people a window to see the inner workings of how an individual's mind works. If one believes the cognitive theorists that there is some cognitive processing involved in creativity, it becomes difficult to deny the involvement of some measure of metacognition. Numerous authors have articulated this view over time in their work on creativity (Cropley, 1999; Feldhusen, 1995; Isaksen & Treffinger, 1985; Pesut, 1990; Sternberg, 1988).

Interestingly, the most thorough blow-by-blow account of connections between creativity and metacognitive processes emerged from someone in the field of children's literacy and the design of curriculum and instruction. Armbruster (1989) used Wallas' stages of creativity Wallas' (1926) in a systematic effort pointing out such connections. She noted that creative individuals are more likely to have knowledge of potential ways of restructuring information (think Piaget's transformations) in the *preparation* stage. Her treatment of Wallas' *verification* stage harkens back to the description of metacognition suggested by Flavell (parenthetical additions added for the sake of conceptual connections):

> In sum, creative individuals seem to be especially adept at the conscious metacognitive skills that are required during the verification stage. They may be unusually sensitive to both internal and external standards and particularly able to revise the creative product accordingly (knowledge of persons, knowledge of tasks). Creative individuals may also be especially good at improving these abilities with experience and practice (knowledge of strategies). (p. 180–181)

The Cognitive-Creative Sifting model echoes Armbruster's argument. Her proposals in the area of metacognition and creativity came nearly 25 years ago and empirical research in this area remains thin. In fact, a meta-analysis by Ma (2009) investigating the effect sizes associated with variables in creativity studies, did not include metacognition in the over 30 groups of variables for which they coded effect sizes in over 100 examples of previous research.

The purpose in this study builds on Flavell, Armbruster, and others. It seeks to examine the (interaction) effect suggested by Feldhusen and Goh (1995), for example, in which metacognition might add to the effectiveness and efficiency by which one can think creatively or demonstrate creativity in the form of a product. Two research questions drive this study: (a) To what extent do levels of metacognition moderate the relationship

between levels of creative ideas and levels of creative production? And (b) do different aspects of metacognition generate different moderator effects?

METHODS

Participants

Participants in this study were recruited from an introductory human development course at a university in the southwestern United States. At the university, the course fulfills an academic core requirement meaning using such a course brought with it an expectation that the sample would be diverse in terms of interests and abilities. Recruitment generated 152 total participants.

The majority of the participants were women ($n = 120$) and the average age of the participants was 19.9 years ($SD = 2.3$). The sample was not as diverse in terms of majors as had been hoped with roughly two-thirds ($n = 91$) declaring a major in either education or some strand of human development. Less than 10% ($n = 12$) were members of the honors college at the university. The median range for GPA, SAT verbal score, and SAT math score were reported as 3.00 to 3.19, 560–599, and 560–599, respectively.

Measures

Creativity Measurement

Given the model of creativity under assessment presently, two measures of creativity were required: one as a measure of creative ideation and one as a measure of creative production. Each was presented to the participants in an online format with the items randomly sorted as a reliability check. The Runco Ideational Behavior Scale (RIBS; Runco, Plucker, & Lim, 2001) short-form is a self-report instrument consisting of 19 items intended to measure how often a subject has thoughts of a certain type as a measure of creative ideation. The short-form RIBS is highly correlated with the long-form that is part of the Runco Creativity Assessment Battery (Runco et al., 2014). Each item is scored on a Likert-type scale from 0 (*never have such thoughts*) to 4 (*have such thoughts about every day*). For example, respondents were asked to apply the scale to "I have ideas for a new business or product" and "I have ideas about what I will be doing 10 years from now." Previous work has shown the Cronbach's alpha of the RIBS to be on the order of 0.90 (Plucker, Runco, & Lim, 2006; Runco et al., 2001). With this sample, the instrument demonstrated a similar result ($\alpha = 0.90$).

The Creative Behavior Inventory (CBI) was developed by Hocevar (1979, 1980) to measure creative outcomes and achievements. This study used the 28 item short-form developed by Dollinger (2003) for a similar purpose. Dollinger reported a high correlation between the long and short forms of the instrument ($r = .90$). Participants responded to each item (e.g., "painted and original picture", or "designed and made a costume") on a scale of 1 (*never did this*) to 4 (*done this more than five times*). As part of the instrument, respondents were directed on many items (the painting item, for

TABLE 2
Reliability Estimates Based on Theorized Elements of Metacognition

	Cronbach's α	*Definition/Conception*	*Sample Item*
Overall	0.94 (52 items)		
Knowledge of Cognition	0.87 (17 items)		
Declarative Knowledge	0.75 (8 items)	Knowledge about one's skills, intellectual resources, and abilities as a learner	I understand my intellectual strengths and weaknesses
Procedural Knowledge	0.61 (4 items)	Knowledge about how to implement learning procedures/strategies	I try to use strategies that have worked in the past
Conditional Knowledge	0.67 (5 items)	Knowledge about when and why to use learning procedures	I use different learning strategies depending on the situation
Regulation of Cognition	0.91 (35 items)		
Planning	0.75 (7 items)	Planning, goal setting, and allocating resources prior to learning	I pace myself while learning in order to have enough time
Information Management	0.74 (10 items)	Skills and strategy sequences used on-line to process information more efficiently	I consciously focus my attention on important information
Monitoring	0.78 (7 items)	Assessment of one's learning or strategy use	I ask myself periodically if I am meeting my goals
Debugging	0.66 (5 items)	Strategies used to correct comprehension and performance errors	I ask others for help when I don't understand something
Evaluation	0.72 (6 items)	Analysis of performance and strategy effectiveness after a learning episode	I ask myself if I have considered all options after I solve a problem

Metacognitive Awareness Inventory Instrument Information.
Note: Definitions from Schraw and Dennison (1994).

example) to exclude creative acts completed as part of school or university work. This intends to paint a clearer picture of ones level of creative production that naturally occurs. Although the long-form CBI offers subscores, the short-form does not, based on the limited number of items. Because of this, the CBI score was treated as a single holistic measure in the analysis. The Cronbach's alpha for the CBI in this sample was similarly high ($\alpha = 0.93$) indicating a substantial degree of internal consistency. Although the format of the two instruments is similar, the response choices are not identical (both in number and scaling) meaning variance associated with method should be minimal.

Metacognition Assessment

The Metacognitive Awareness Inventory (MAI), developed by Schraw and Dennison (1994), was used in this study as the measure of metacognition. It a self-report measure with 52 items in true–false format. In this study, participants were presented a four-point Likert scale on which to respond for each item. Schraw and Dennison's approach to conceptualizing metacognition led them to two related subconstructs (knowledge of cognition and regulation of cognition). They did, however, suggest a breaking down of these categories even further, but their analysis did not support the more fragmented structure. Despite those problems, because identifying specific components of metacognition as potential moderators is a stated goal in this study, Table 2 is included to provide information on these eight categories including a sample item. Table 2 also includes Cronbach's alpha values from the present study for the overall MAI, the two main factors identified by Schraw and Dennison, and for each for the eight categories for context in the later analysis.

RESULTS

Bivariate correlations between the observed variables (scores RIBS, CBI, MAI) were calculated as a first step toward understanding the relationships under investigation. Table 3 summarizes these correlations including those for the MAI broken down into the subcomponents suggested by Schraw and Dennison. Small- to medium-sized ($r = .32$ to $r = .56$), statistically significant correlations ($p < .01$) were observed for all relationships involving between the three full scales. All subcomponents of the MAI showed statistical significance related to the RIBS and a similar range of correlations ($.41 < r < .54$). Both the knowledge of cognition and regulation of cognition scales demonstrated statistical significance in their relationship to the CBI ($p < .01$) but the correlations were smaller ($r = .25$ and $r = .33$, respectively). Seven of the eight subcomponents of metacognition showed statistical significance related to the CBI ($p < .01$). The other subcomponent, conditional knowledge, was statistically significant at the $p < .05$ level. Correlations for the subcomponents ranged from $r = .21$ for conditional knowledge to a high of $r = .35$ for information management.

Evaluating the moderator effect of metacognition on the interaction was completed using stepwise regression. Mean-centered values of the RIBS and MAI were calculated for each participant as well as an interaction term (the product of mean-centered RIBS and mean-centered MAI). CBI scores were then regressed, first, on the RIBS and MAI values, then on these terms and the additional interaction term. The difference in the multiple R^2 value for these analyses generates a measure of moderator effect (Aiken & West, 1991). Additionally, f^2 effect sizes (Cohen, 1988) were calculated. The process

TABLE 3
Pearson *r* Correlations between Observed Variables Scores ($n = 152$)

	RIBS	*CBI*	*MAI*	*MAIk*	*MAIr*	*M_DK*	*M_PK*	*M_CK*	*M_P*	*M_IMS*	*M_M*	*M_DS*	*M_E*
RIBS	1.00												
CBI	.52**	1.00											
MAI	.56**	.32**	1.00										
MAIk	.48**	.25**	.89**	1.00									
MAIr	.56**	.33**	.98**	.77**	1.00								
M_DK	.43**	.21**	.78**	.91**	.65**	1.00							
M_PK	.41**	.27**	.78**	.83**	.71**	.62**	1.00						
M_CK	.45**	.21*	.80**	.89**	.69**	.69**	.68**	1.00					
M_P	.47**	.26**	.85**	.66**	.88**	.59**	.60**	.58**	1.00				
M_IMS	.54**	.35**	.83**	.67**	.85**	.57**	.58**	.62**	.64**	1.00			
M_M	.44**	.27**	.87**	.67**	.89**	.54**	.66**	.62**	.76**	.68**	1.00		
M_DS	.41**	.23**	.69**	.58**	.69**	.50**	.58**	.48**	.49**	.59**	.54**	1.00	
M_E	.44**	.25**	.79**	.60**	.82**	.52**	.53**	.55**	.69**	.56**	.72**	.43**	1.00

Note: *indicates $p < .05$; **indicates $p < .01$; MAIk = knowledge of cognition; MAIr = regulation of cognition; M_DK = declarative knowledge; M_PK = procedural knowledge; M_CK = conditional knowledge; M_P = planning; M_IMS = information management; M_M = monitoring; M_DS = debugging; M_E = evaluation.

TABLE 4
Moderating Effects of Theorized Elements of Metacognition on Creative Production

	R^2 *Full Model*	R^2 *change for interaction*	*p-value*	*Cohen f2*	*Effect Size*
Overall Metacognition	0.294	0.022	0.033	0.031	Large
Knowledge of Cognition	0.299	0.028	0.016	0.040	Large
Declarative Knowledge	0.300	0.029	0.015	0.041	Large
Procedural Knowledge	0.292	0.017	0.059	0.025	Large
Conditional Knowledge	0.293	0.021	0.040	0.029	Large
Regulation of Cognition	0.291	0.018	0.057	0.025	Large
Planning	0.282	0.011	0.139	0.015	Medium
Information Management	0.292	0.015	0.080	0.021	Medium
Monitoring	0.290	0.017	0.063	0.024	Medium
Debugging	0.291	0.020	0.043	0.028	Large
Evaluation	0.287	0.015	0.076	0.022	Medium

RIBS by MAI component interaction effects.
Note: Effect size characterization based on standards established for moderation analyses by Aguinis et al. (2005).

of mean-centering and stepwise regression was repeated for each component in the two-component and eight-component conceptions of metacognition (Schraw & Dennison, 1994). Table 4 offers a summary these results.

MAI scores were a statistically significant moderator ($p < .05$) on the relationship between RIBS and CBI scores with an effect of represented by an R^2 change of .022 and a Cohen's f^2 of .031. By Cohen's (1988) standards, this effect would be characterized as small, but suggestions by other authors based on the extent of effects generally observed in moderation analyses would lead to the characterization of a large effect (Aguinis, Beaty, Boik, & Pierce, 2005).

Knowledge of cognition demonstrated a larger moderator effect ($\Delta R^2 = .028$, $f^2 = .040$) than regulation of cognition ($\Delta R^2 = .018$, $f^2 = .025$). The former was statistically significant ($p < .05$) and the latter missed that criterion only slightly ($p = .057$). Both effects were large based on the Aguinis et al. (2005) classifications. The patterns observed when considering moderator effects for the eight subcomponents were similar to the two component results. The three knowledge of cognition subcomponents showed large moderator effects while the regulation subcomponents were classified as medium, except for debugging strategies. It was the only element under regulation of cognition that was statistically significant ($\Delta R^2 = .020$, $f^2 = .028$, $p < .05$). Among the knowledge of cognition components, levels of declarative knowledge showed the largest moderator effect ($\Delta R^2 = .029$, $f^2 = .041$, $p < .05$). Conditional knowledge also exhibited a statistically significant moderator effect ($p < .05$).

DISCUSSION

Testing the validity of the Cognitive-Creative Sifting model was the overarching purpose of this study. The findings here that 70% of the variance in creative production was not explained by variation in creative ideation suggests a considerable amount of disconnect in what is being measured in creativity studies depending on one's point of view (ideation vs. production). In this study, metacognition was investigated as potential example of such a sifter that would moderate the ideation-production relationship (Research Question 1). Results suggested it is a moderator of relatively large effect size supporting the proposed Cognitive-Creative Sifting model.

Research Question 2 subcomponents of metacognition were examined. In the two component conception, knowledge of cognition clearly had a greater influence than regulation of cognition that parallels Flavell's emphasis on the knowledge component of metacognition itself (1979) and the connections of metacognition to creativity suggested in previous literature. Digging deeper with the eight component model revealed declarative knowledge (knowledge of self, resources, and ability) as the strongest moderator. This supports Armbruster's (1989) work regarding Wallas' (1926) verification stage suggesting the importance of internal standards and knowledge of external valuation. The importance of Piaget's transformations (1973) seem supported by the effect of conditional metacognitive knowledge—the when and why of restructuring information. A knowledge of the field also supports this conditional knowledge. Furthermore, this when-and-why consideration also aligns with theorizing by Kaufman and Beghetto (2013) regarding teaching an appreciation of when creative acts are appropriate in a given setting.

The subcomponents nested under regulation of cognition showed lower effects, but were still impactful and offered connections to previous literature. Debugging strategies showed the only large moderating effect of the five in this group which seemed a bit out of place. However, one could argue the connection of this factor

to Flavell's knowledge of strategies concept (1979). One could also make the case for a fine line between the elements of conditional knowledge in terms of awareness of a field/domain and an evaluation and interaction with that field/domain. Ultimately, this is a critical element, accounts for differences between the subcomponents, and binds the metacognition and creativity literature together. Although all subcomponents had some effect, those that influenced ones knowledge of self, the field, or the interaction thereof were more influential on the relationship between creative ideation and creative production.

LIMITATIONS AND FUTURE RESEARCH

In this study, the findings may be colored by the nature of the sample. First, the sample of university students may not be representative of a broader population in terms of the measured variables. They may have generally higher cognitive ability, for example, which this study did not control for. Future research ought to apply the theoretical framework to either more diverse groups (by age, by major, by cognitive ability, by gender) or in different subpoplations specfically to look for similarities and differences in the patterns observed. For example, a study could be completed with students in the honors college at the university or with a group of high school students or of middle aged adults (perhaps faculty).

Another limitation of the study is the nature of the measures themselves. First, the self-report nature of the instruments invites validity issues. Next, given the multitude of creativity measures available, one can imagine that different measures may have produced different results. It may be that the RIBS measure, although intended as an ideation measure, doesn't tap into the base-level skills of ideation. Some items may, themselves, already take into account some of the cognitve-creative sifting as part of the response. This would cut into the unique effect that could be observed via the MAI instrument. A more traditional measure of divergent thinking such as the Torrance Test of Creative Thinking (Torrance, 1974) might be an appropriate option in future studies.

Rethinking the use of the CBI and MAI might also be in order. An interesting question about creative production might be to consider quantity and quality of production separately. The CBI short-form contains items primarily focused on quantity (24 of 28 items) so making such a distinction didn't seem reasonable. The longer form which includes more questions more directly related to quality could be used in future studies. Participants in future studies might also be asked to generate some product that could be evaluated for its level of creativity, perhaps by Amabile's Consensual Assessment Technique Amabile (1982). As for the metacognition measure, the nebulous nature of the construct makes assessment difficult. Perhaps in a larger sample, a factor analysis of the MAI could reasonably be used to generate the subcomponents for moderation analysis. Additonal measures of different potential filters could also offer avenues of research. Personality measures might influence the ideation-production relationship as might more complex divergent-convergent tasks like the Remote Associations Test (Mednick, 1962).

Despite these shortcomings and needs for follow-up research, this study demonstrates promise on the value of, at least some, metacognitive skills in fostering creative development. In particular, there may be applications in the field of gifted and talented education. Students are often identified for programs based on their creativity (typically measured by a divergent thinking test) and then educators wonder why some students don't live up to that perceived potential. This study suggests that individuals in the higher percentiles for ideation may specifically benefit from training in metacognitve awareness. Incoportating cognitive interventions aimed at developing these skills may improve the efficacy of programs aimed at the creatively gifted. Diagnostic assessment for metacognitive skills could also be incorporated in a battery of tests used for gifted-student identification, with a mind to identifying students who not only generate ideas, but may be in a better position cognitively to generate creative products.

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