

Generating More Ideas Makes Me Feel Better, Yet I Still Like My First Idea: Metacognitive Decisions when Generating and Selecting Ideas

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ABSTRACT

In one experiment, we randomly assigned participants to either generate one or three ideas to open a new business. Participants were instructed that the ideas needed to be original and effective. Afterward, participants completed a battery of questionnaires assessing metacognitive feelings, comparative evaluations of the idea generated, and some demographics. Participants in the one-idea condition generated more original ideas only when compared to the first idea generated by participants in the three-idea condition. When we made a comparison between the most original and effective idea generated in the three-idea condition, participants in the three-idea condition generated more original and effective ideas than participants in the one-idea condition. Participants in the three-idea condition were not aware that they had generated more original and effective ideas than what they thought by selecting their most creative idea. The serial order effect was supported for evaluations of originality. Conversely, the evaluations of effectiveness showed the opposite pattern. All results were interpreted in light of creative metacognition.

KEYWORDS:

Creative metacognition; Idea evaluation; idea selection; metacognitive feelings; serial order effect

Article history:

Received: June 21, 2024

Received in revised form: May 18, 2025

Accepted: June 4, 2025

ISSN 2354-0036

DOI: 10.2478/ctra-2025-0005

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The ideation process involves thinking about ideas (cognition), thinking about thinking, including the evaluation and selection of ideas (metacognition), and experiencing metacognitive feelings that come from thinking about thinking. This entire process is captured by recent developments of the model of creative metacognition (Lebuda & Benedek, 2023) that has substantially energized empirical work on metacognition as a subset of creative self-regulation (See Urban & Urban, 2024, for a recent example). The creative metacognition model provides a guiding framework to explore the creative process. We seek to make a modest contribution by integrating and testing different streams of research to answer the following research questions: 1) Are there differences in originality and effectiveness of ideas generated under the different requirements of asking individuals to generate one versus three ideas? The manipulation of asking to generate one versus three ideas is a means to an end, a means to explore relevant metacognitive questions. 2) Do participants rate their chosen idea or their only generated idea as higher in originality and effectiveness, among others, when asked to generate one versus three ideas? Asking participants to generate one versus three ideas also allows us to test these types of questions with metacognitive implications. 3) Does the serial order effect, widely supported in creativity research (see Beaty & Silvia, 2012), hold when evaluating originality and effectiveness separately or do the patterns diverge over time? These three research questions drive our review of conceptual models and empirical studies. One experimental study with a large sample provides the means to test and partially answer these three questions and some related sub-questions. We briefly describe the creative metacognition conceptual model before starting with our first research question.

THE CREATIVE METACOGNITION MODEL

The creative metacognition model proposes three metacognitive components (namely, knowledge, control, and monitoring) operating at three levels: task, performance, and response (Lebuda & Benedek, 2023) that influence each other. All three components interact to influence creative performance. Creative performance involves idea generation, which is the focus of our investigation. This metacognitive framework serves to guide our three research questions.

The knowledge component involves semantic and episodic knowledge related to the problem to be solved and to the process of idea generation. Monitoring involves different indicators that shed light on the process of generating ideas. One of these indicators is metacognitive experiences or feelings, which act as cues that individuals use to make inferences about the process of idea generation (see Efklides, 2006; Koriat, 2006, for some of the first discussions on feelings, and Lebuda & Benedek, 2024, for recent empirical support) by providing information (Puente-Díaz, 2023). Evaluation of candidate responses is also part of the monitoring component. The control component also includes multiple indicators involving any efforts or actions to continue, terminate, or improve the process of idea generation. The three-component model has recently received empirical support (Lebuda & Benedek, 2024), suggesting that the model is robust in understanding how metacogni-

tion and creative ideation interact. Yet, even though the three-component model has been a significant development, we still need more conceptual and empirical work to examine the multiple indicators that could be proxies of each of the three components. This is what we intend to do in our study by focusing on metacognitive feelings, evaluations of candidate responses in an idea-generation task, as well as originality and effectiveness scores as rated by judges.

One of the contributions of the creative metacognition model is the proposition that the criteria for generating creative ideas and solving creative problems are ambiguous (Lebuda & Benedek, 2023). They are ambiguous because problems are usually ill-defined with multiple answers. Creativity scholars in business fields suggest that this ambiguity is even higher when trying to solve business problems with realistic tasks (See Mumford et al, 2020, for a conceptual discussion; and Medeiros et al., 2014, for an empirical study). Previous conceptual developments have been useful in developing the concept of metacognition but they lack an explicit emphasis on creative problems (e.g., Efklides, 2006; Koriat, 2006; Schwarz, 2004), such as the one given by the creative metacognition model (Lebuda & Benedek, 2023). The ambiguity of seeking to generate creative ideas can have several manifestations. Individuals could, for example, generate as many ideas as possible or generate only a few creative ideas, focusing their efforts on generating and reporting only truly creative ideas. These types of decisions are metacognitive because they involve evaluating candidate responses, cognitive output, and idea-generation strategies (question 1 to be discussed later). These types of metacognitive decisions fall directly into monitoring metacognition and more indirectly into the control components of metacognition because it implies generating many versus few ideas. Hence, this model is well-suited to guide our discussion of research question 1, which will be explained later on.

In addition and consistent with the creative metacognition model (Lebuda & Benedek, 2023), the ambiguity of the criteria for creative ideas, the lack of sources of information to evaluate each idea on the criteria of being creative (Puente-Díaz, 2023), and the desire to implement some ideas, make the evaluations of candidate responses relevant to understanding metacognition as a process (Puente-Díaz & Puerta-Sierra, 2024). The evaluation of candidate responses, local and global (Urban & Urban, 2024), informs important decisions, such as idea selection and implementation. In addition, how individuals feel during the ideation process can also provide information (Efklides, 2006; Koriat, 2006; Puente-Díaz, 2023). This is addressed in question 2.

Last, individuals could decide to emphasize generating original ideas or focus more on generating effective ideas, or both. The interplay between originality and effectiveness is widely discussed in applied contexts (see Linchfield, 2008; Lucas & Nordgreen, 2021) because it is a decision with metacognitive implications. Hence, the creative metacognition model represents a robust framework to guide research question 3. We briefly discuss each research question next.

1) Are there differences in the originality, effectiveness, and overall creativity of ideas generated under the different requirements of asking individuals to generate one versus three ideas?

Examining this type of question can be brought down to two main sources: One coming from social psychology and the other from creativity research. Asking individuals to recall or to generate a few ideas versus many is a means to an end. It is a manipulation to test how mental operations influence evaluations and idea generation. It is a means to explore metacognitive monitoring, metacognitive experiences or feelings, and the evaluation of candidate responses and control (Lebuda & Benedek, 2023), because individuals might use different strategies. It could also tell us indirectly how individuals regulate their efforts (see Urban & Urban, 2024, for a study on metacognitive regulation). Individuals asked to generate just one idea might inhibit responses that do not meet the criteria of being original and effective before reporting their “best idea.” Inhibiting responses implies evaluation of candidate responses, which is a metacognitive process because individuals are thinking about their cognitive output. Conversely, individuals in the generate-many-ideas condition might not be as motivated to inhibit ideas because they are required to generate several ideas. Hence, deciding which ideas to report is a metacognitive decision involving evaluation of candidate responses to improve, continue, or terminate the process of idea generation. We discuss how these types of questions have been addressed in social psychology and creativity research.

SOCIAL PSYCHOLOGY RESEARCH

In social psychology, the work of Schwarz and colleagues (1991) was the first to test how manipulating a required number of examples to bring to mind, few versus many, could shed light on mental operations, including metacognitive feelings and the role of content information. Even though this first study was not about creativity, it has important implications because during the ideation process, individuals could be asked to generate few versus many ideas. This first study led to hundreds of replications using this experimental manipulation to test the role of metacognitive feelings in the form of ease of recall and content information in the form of the amount of information brought to mind by recalling few versus many examples. Conceptual developments on this relatively simple manipulation are as follows. Bringing to mind a few examples should be experienced with greater ease of recall than bringing to mind many because individuals are asked to generate less (more) information (See Schwarz, 2024; Schwarz et al., 2021, for conceptual developments). This ease is experienced as a metacognitive feeling because it comes from the act of thinking. These feelings are subject to many interpretations driven by naïve theories. Naïve theories are a set of beliefs about the meaning of metacognitive feelings (Unkelbach & Greifeneder, 2013). For example, recalling a few instances of assertiveness should be experienced as easier or with greater ease than recalling many examples. One relevant naïve theory is that “I should not be very assertive because it is difficult to recall many examples.” In social psychology, the most common finding was that metacognitive feelings played an important role when making self-assessments or evaluations

(See Schwarz et al., 2021, for a recent overview). Relating this to the ideation process, generating a few ideas in divergent thinking tasks could be perceived as easier than generating many ideas. The feeling of ease experienced by generating only a few ideas could be interpreted as cues of how well the process is going and about the quality of the ideas generated, the evaluation of candidate responses (Efklides, 2006). Yet the naïve theory relevant to idea generation is not as clear as in the example just explained about assertiveness, nor is it clear whether metacognitive feelings should facilitate idea generation. A recent model of insight versus persistence beliefs in idea generation comes close to being considered a naïve theory (Lucas & Mai, 2022). This model suggests that some individuals might believe that ideas are generated spontaneously, without much effort, whereas others might believe that idea generation is facilitated by persistence and a significant amount of effort. It is a naïve theory because the construal comes from idea generators. Yet it does not directly address how the mind should feel, with ease or difficulty, while generating ideas, because it focuses mainly on lay beliefs.

Besides the role of metacognitive feelings, there is a second explanation for manipulating few versus many examples. The second alternative is the amount of information brought to mind or generated by the mind. Generating many versus few ideas or recalling many versus few instances of assertive behavior brings more information to mind (e.g., individuals have more evidence because they generate more ideas or bring more examples to mind; See Schwarz et al., 2021, for a recent overview). More information could provide robust evidence of assertiveness or the quality of ideas. This distinction is discussed by metacognitive memory scholars and suggests a difference between information-based judgments vs. experience-based judgments (See Koriat, 2006, for some of the earlier conceptual developments). Hence, individuals could use both sources of information to make judgments or evaluations. Bringing to mind more information or generating more ideas could be more influential than the metacognitive feelings experienced while generating ideas with ease. Whether the amount of information brought to mind or metacognitive feelings is more influential depends on several factors, including the naïve theory used to interpret the experience of ease or difficulty (Schwarz et al., 2021).

One study in creativity research (Puente-Díaz & Cavazos-Arroyo, 2020) used conceptual developments just explained in social psychology to examine the role of metacognitive feelings in the process of idea generation, manipulating the amount of information brought to mind by randomly assigning participants to one of two conditions: 2 versus 6 instances of creative idea generation and assessing creative self-efficacy and originality scores as rated by judges. Results showed that recalling 2 instances of creative idea generation led to greater metacognitive feelings experienced as ease of recall than recalling six instances, which then had a positive direct relationship with creative self-efficacy and a positive indirect relationship with originality scores coming from an idea generation task (Puente-Díaz & Cavazos-Arroyo, 2020). From these results, we could claim that metacognitive feelings experienced as the ease of recalling examples of creative idea generation were more influential than the amount of information generated. That is, metacognitive feelings were used as a source of information (Efklides, 2011). Intuitively, more examples brought to mind might

help individuals feel better about their creative abilities, yet the opposite was found. Whether similar results could be observed by manipulating the requested number of creative ideas is an open question. Hence, in our study we ask participants to generate one versus three ideas for opening a new business. Opening a new business was conceptualized as a type of divergent thinking task that requires participants to generate original and effective ideas, creative ideas.

Creativity research

The second source comes from a study conducted by Reiter-Palmon and Arreola (2015). The authors used a similar experimental manipulation by requesting individuals to generate one versus many creative ideas to solve a management problem, but under a different conceptual framework. Specifically, the work of Reiter-Palmon and Arreola (2015) was concerned with how creativity was conceptualized and operationalized. This article was not framed under the umbrella of metacognition, even though it had many metacognitive implications. Hence, several interesting metacognitive questions were not explicitly addressed. The authors suggested that participants in the one-idea condition should be more inclined to elaborate on their ideas than in the many-idea condition. A recent study showed the importance of the tradeoff between elaboration and the number of ideas generated (Gonthier & Besancon, 2022). The hypothesis of greater elaboration could be interpreted as a metacognitive decision in which participants decided to allocate greater time, effort, or focus on just one idea as opposed to having to allocate their time, effort, and focus on many ideas. This type of decision has implications for metacognitive monitoring and control, consistent with some postulates of the creative metacognition model (Lebuda & Benedek, 20023). Given the exploratory nature of this article, many differences between conditions were tested. Among the tested differences, one showed that participants in the one-idea condition generated ideas with higher scores on originality when compared to the average originality of all ideas generated in the many-idea condition. When using the best-selected idea (as selected by participants in the many-idea condition), participants in the one-idea condition generated higher originality scores than participants in the many-idea condition. From a metacognitive perspective, one could argue that participants did not select their most original idea because the scores of the best-selected idea were not higher than the scores on the one-idea condition. In addition, one could argue that participants who only focused on one idea were able to generate more original ideas than participants who focused on many ideas but had the chance to select their most original idea. Yet, results showed that participants in the many-idea condition generated higher originality scores, as shown in their most original idea, than participants in the one-idea condition. Yet on average, they did not select their most original idea. One conclusion from these findings is that participants in the many-idea condition did not see their performance hindered by having to generate many ideas. The main problem was not realizing that of the ideas generated, there were other ideas with higher originality than those selected by the participants. These results could have implications for creative metacognition because they involve evaluating candidate responses and selecting the most original idea (Lebuda & Benedek, 2023).

Manipulating the requested number of ideas to be generated is a means to an end. It is a manipulation to explore different metacognitive questions. There is nothing inherently interesting or insightful in having participants generate one versus three ideas or any other numbers. It is the metacognitive questions that we could answer that drive our decision to use this manipulation. The questions could be related to explicit or implicit decisions and outcomes coming from generating three versus one idea, as executed in the current study. Outcomes could be objective (e.g., originality scores as rated by independent judges) or subjective (e.g., evaluations of candidate responses by participants). Examining objective and subjective outcomes could shed light on mental operations executed while generating ideas and on the nature of creative problems. We first focus on objective outcomes conceptualized as originality and effectiveness scores of the idea generated as rated by independent judges. Subjective scores are discussed next under our second research question. Question 1 is consistent with the need to empirically test the contribution of the monitoring and control components of the creative metacognition model (Lebuda & Benedek, 2024).

2) Do participants evaluate their selected idea or their single generated idea better when asked to generate one versus three ideas?

The conceptual basis of this second question was partially covered in question 1, but we now focus on evaluations of candidate responses by participants, which can be seen as an indicator of metacognitive monitoring (Lebuda & Benedek, 2023), and on metacognitive feelings, which could be seen as an indicator of metacognitive monitoring as well. Both metacognitive feelings and evaluations of candidate responses could vary as a function of requesting participants to generate one or three ideas. Hence, we directly make this comparison in our results. Potential differences could come from two possibilities. 1) If metacognitive feelings are more influential, participants should evaluate their ideas higher when experiencing ease of idea generation than participants who did not experience ease of idea generation, which is more likely to happen in the one-idea condition. Yet, this might not be the case if participants do not hold a naïve theory about the meaning of the perceived ease. Another explanation is that the difference between generating one versus three ideas is not strong enough to elicit significant differences between both conditions in metacognitive feelings. The influence of the manipulation of generating one versus three ideas on the evaluation of candidate responses is also consistent with the proposition that control and monitoring components interact to influence creative behavior (Lebuda & Benedek, 2023). We test this in our experiment.

2) This second possibility, already partially discussed in question 1, also involves the amount of information brought to mind. The amount of information brought to mind or generated is conceptualized as declarative information that could influence the evaluation of candidate responses (Schwarz, 2004). Participants in the three-idea condition should generate more information than participants in the one-idea condition, covering a wider problem space. If the amount of information brought to mind is more influential, participants in the three-idea condition should report higher levels of originality and effectiveness of their ideas. This second alternative is also contem-

plated. The distinction between evaluation of candidate responses based on feelings versus information has been discussed by different metacognitive scholars previously (See Koriat, 2006; Schwarz, 2004).

In sum, questions 1 and 2 deal with similar issues. Question 1 focuses on objective indicators of originality and effectiveness as rated by judges. Question 2 deals with evaluations of candidate responses by participants. As stated earlier, both possibilities are tested. Both possibilities seek to test how the monitoring and control components of creative metacognition interact or influence the ideation process (Lebuda & Benedek, 2023).

3) Does the serial order effect, widely supported in creativity research (see Beaty & Silvia, 2012), hold when evaluating originality and effectiveness separately or do the patterns diverge over time?

Most creativity researchers agree that a creative idea should be original and effective. Yet, there are important differences in how the creativity of an idea is operationalized and measured. One strategy asks judges to give an overall rating of creativity of the ideas evaluated under the definition that a creative idea should be original and effective (See Amabile, 1996, for an explanation of the consensual assessment and its representation as one number). It is not exactly clear what the evaluation entails given that a high score of 9, on a scale from 1 to 10, could mean that the idea is highly original but not as effective, highly effective but not as original, or both, given that individuals are asked to choose a value that represents an overall evaluation of creativity. In other words, it is not entirely clear how judges or individuals weigh each of the two dimensions because they are asked to provide an overall rating that includes originality as well as effectiveness. While it is hard to make a broad generalization, it seems that researchers using traditional divergent thinking problems, such as finding creative uses for bricks, tend to favor this strategy. Indeed, one of the most cited studies on the serial order effect (Beaty & Silvia, 2012) followed this strategy to obtain robust evidence on the serial order effect.

The second strategy involves evaluating originality and effectiveness separately and, often, creating a composite score (e.g., Lucas & Nordgreen, 2021 & Mumford et al., 2012). This second approach allows researchers to examine how individuals might emphasize originality over effectiveness or vice versa and whether ideas reported tend to get more original or effective over time. Thus, it allows researchers to capture how idea generators work on specific aspects of their ideas. This second approach posits that the goals of generating original and effective ideas are independent and ambiguous (Linchfield, 2008). Given their independence and ambiguity, they might be subject to different interpretations and strategies (Lucas & Nordgreen, 2021), which might have metacognitive implications.

The implications of the interplay between originality and effectiveness were initially proposed by Mueller and colleagues (2012) to explain why individuals desire originality but sometimes prefer effectiveness (the authors used the concept of practicality). The tension between originality and effectiveness was labeled as a bias against creativity. In terms of idea generation, for example,

one idea might be highly original but may lack effectiveness. Idea generators could seek to improve effectiveness before socializing and materializing their idea. While it is hard to generalize, researchers using more realistic divergent thinking tasks, in which idea generators are asked to solve organizational and business problems, tend to favor this second strategy (Sullivan & Ford, 2010). Under these more realistic tasks, there are benefits to evaluating each component separately. More realistic divergent thinking tasks are also likely to present idea generators with realistic dilemmas between emphasizing originality, effectiveness, or both. This is especially so because the goal of generating something original, effective, or original and effective is ambiguous (Linchfield, 2008). We take this second approach to examine the serial order effect. To do so, we use the realistic task of asking participants to generate ideas to open new businesses, where important differences in originality and effectiveness are expected and where differences in the emphasis given to originality or effectiveness might exist.

At first glance, questions 1 and 2 might not appear to be connected to question 3. Yet, in fact, they are all connected. The one-idea condition represents a needed comparison group to answer many relevant metacognitive questions related to the three-idea condition. Within the three-idea condition, we can assess optimal or suboptimal decision-making compared to the one-idea condition. All three questions are connected from a metacognitive perspective. All three questions also involve the interaction between the control and monitoring components of creative metacognition (Lebuda & Benedek, 2023).

One caveat is in order. In addition to separating the assessment of originality and effectiveness, there are important differences in the interpretation and implications of the serial order effect (Beaty & Silvia, 2012; Lucas & Nordgreen, 2020; Puente-Díaz & Cavazos-Arroyo, 2021; Sidi et al., 2020). These additional implications will not be explored. This decision is based on presenting results that have some degree of parsimony, but we acknowledge that it is one limitation of our study. We also acknowledge the need for conceptual developments integrating research on serial order effects and their metacognitive implications.

In sum, the purpose of the present investigation is to shed light on the three research questions explained in our introduction using the creative metacognition model as our guiding framework (Lebuda & Benedek, 2023). The three questions involve objective and subjective creativity scores and separate the examination of the serial order effect into the dimensions of originality and effectiveness, expecting a divergent pattern if individuals decide to emphasize one over the other. These three questions seek to make a modest contribution to current efforts to empirically test how the control and monitoring components of creative metacognition interact during the ideation process (See Lebuda & Benedek, 2024, for a recent empirical investigation).

OVERVIEW OF STUDY

We conducted one experiment to answer our research questions. The experiment allowed us to manipulate the number of ideas requested, one versus three. We posit that this manipulation can shed light on metacognitive indicators organized around our three research questions. We collected data from the beginning until the end of a regular semester (16 weeks), seeking to have more than 328 participants. The value of 328 participants came from a power analysis with the specifications of an F test, ANOVA, two groups, a medium effect size of .20, with an alpha value of .05 (Faul et al., 2007). The study received approval from the human subjects committee of University xxxxx.

METHOD

Participants

416 college business students (69% females, 96% in the 18-25 age bracket) from two private universities in Mexico completed our study voluntarily without any financial compensation. We did not set any time limits. It took between 15 to 20 minutes to complete all measures and the idea generation task. Participants had experience in generating ideas to solve business problems. In addition, the participants also had experience in entrepreneurship, which involves opening new businesses.

Procedure and measures

Participants were randomly assigned to one of two conditions, read the respective instructions, and completed one of the following two tasks:

One idea for a new business: Participants read the following instructions: "Let's suppose that you have the need to open a new business soon with low investment. This business will represent your main source of income. Please, write in the space below **one idea** that comes to mind. The idea should be original and effective, creative."

Three ideas for a new business: Participants read the following instructions: "Let's suppose that you have the need to open a new business soon with low investment. This business will represent your main source of income. Please, write in the space below **three ideas** that come to mind. The idea should be original and effective, creative."

By randomly assigning participants to one of the two conditions and having a large sample, we controlled for any differences between the two groups that could influence the results. Hence, the three-idea condition and the one-idea condition only differed in the requested number of ideas to be generated (e.g, age distribution was almost identical).

After completing the experimental task, participants were asked to complete a questionnaire assessing metacognitive feelings, to choose their most creative idea (only in the three-idea condition), and to complete a questionnaire assessing the creativity of their ideas as compared to the

ideas generated by others as a proxy of evaluation of candidate responses. The metacognitive feeling questionnaire uses six items to assess feelings on a scale from 1 (I did not feel that at all) to 10 (completely felt like that; see Puente-Díaz et al., 2021). Sample items were: “I felt that idea generation task was easy” and “I felt that it was easy to recall relevant information” ($\alpha=.91$ for total score). As mentioned earlier, the metacognitive feeling questionnaire was completed only one time after generating ideas.

For evaluation of candidate responses, participants were informed that: “Many students completed the same task of developing ideas for new businesses. We want to know your opinion about your idea in relation to the ideas generated by others.” The items were: “I believe my idea is more original than the rest,” “I believe my idea is more effective than the rest,” “I believe my idea is more surprising than the rest,” “I believe my idea is more creative than the rest,” and “I believe that my idea has a higher probability of success than the rest” ($\alpha=.92$ for total score). The items were answered on a scale from 1 (I did not feel that at all) to 10 (completely felt like that). The items used the three-criteria conceptualization of creativity (See Simonton, 2012) with the addition of an overall creativity assessment and an item reflecting the projected success of the idea generated in a business, competitive context. The scale attempted to ask questions relevant to competitive, zero-sum types of contexts, such as the ones found in business settings. While it is true that participants did not have access to the ideas generated by others, we believe the comparative evaluations are relevant because, in business settings, individuals make inferences about the originality and effectiveness of their ideas in relation to what others might have generated to evaluate their decisions and implement their ideas. In the three-idea condition, participants completed this questionnaire after selecting their most creative idea. Hence, in both conditions, evaluations of candidate responses were completed in reference to only one idea after completing the entire idea-generation task.

Two judges, blind to the theoretical development of the study and its experimental procedure, evaluated all ideas on a scale from 1 (not original/effective at all) to 10 (very original/effective), generating one score for originality and one for effectiveness. Obtained scores showed acceptable levels of internal consistency ($ICC=.79, .78$, respectively). Hence, these scores were used as a proxy of creativity scores and were similar to the comparative self-evaluation conducted by the participants (in comparative self-evaluations, probability of success, surprise, and overall creativity were also evaluated). Both scores, one for originality and one for effectiveness, were used separately in our statistical analyses.

RESULTS

Research question 1

We conducted several analyses of variance (ANOVA) to test the effect of the experimental condition, one versus three ideas, on metacognitive feelings, originality and effectiveness scores as judged by raters, and the five dimensions of comparative evaluations of candidate responses (See Tables 1

and 2 for descriptive statistics, effect sizes, and correlations). As suggested by Reiter-Palmon and Arreola (2015), the condition where participants generated more than one idea allowed the examination of many relevant questions with metacognitive implications. Hence, we divided our analysis into different subsections, highlighting the focus of the comparison.

Table 1. Descriptive statistics across both conditions

	Condition				
	One idea		Three idea		Effect Size
	Mean	SD	Mean	SD	
Objective indicators (rated by judges)					Cohen's d
Originality first idea	3.31 ¹	1.45	3.01	1.30	0.15
Effectiveness first idea	6.75	1.35	6.82	1.57	-0.04
*Self-selected: Originality	3.31	1.45	3.18	1.37	0.09
*Self-selected: Effectiveness	6.75	1.35	6.48	1.71	0.18
*Most creative as judged by raters: Originality	3.31 ¹	1.45	3.71	1.57	-0.26
*Most creative as judged by raters: Effectiveness	6.75 ¹	1.35	7.12	1.34	-0.28
Subjective indicators (self-evaluations)					
Metacognitive feelings	7.99	1.44	7.89	1.71	0.06
Originality	5.70 ¹	2.61	6.67	2.62	-0.37
Effectiveness	5.86 ¹	2.64	7.60	2.38	-0.69
Surprise	5.45 ¹	2.50	6.79	2.43	-0.54
Creativity	5.53 ¹	2.74	6.76	2.51	-0.47
Probability of success	6.80 ¹	2.52	8.23	2.90	-0.53
	N = 189		N = 227		

* Self-selection and most creative idea only apply to the three-idea condition

¹ Significant difference between conditions at the .05 level

Table 2. Bivariate correlations

	1	2	3	4	5	6	7
Metacognitive feelings (1)							
Originality first idea (2)	0.021						
Effectiveness first idea (3)	-0.073	-0.24 ¹					
*Self-selected: Originality (4)	0.064	0.789 ¹	-0.142 ¹				
*Self-selected: Effectiveness (5)	-0.073	-0.12 ¹	0.800 ¹	-0.171 ¹			
*Most creative as judged by raters: Originality (6)	0.034	0.705 ¹	-0.112 ¹	0.797 ¹	-0.125 ¹		
*Most creative as judged by raters: Effectiveness (7)	-0.098	-0.165 ¹	0.748 ¹	-0.182 ¹	0.705 ¹	-0.212 ¹	
N = 416 combining both conditions							

* Self-selection and most creative idea only apply to the three-idea condition

¹ Significant at the .05 level

Metacognitive feelings. Results for metacognitive feelings revealed a non-significant effect of the experimental condition, $F(1, 415) < 1$, showing that participants in the one-idea condition did not experience greater ease of idea generation than participants in the three-idea condition (See Table 1 for all means and standard deviations).

First idea generated in both experimental conditions. Results for originality scores revealed a significant effect of the experimental condition, $F(1, 415) = 4.96$, $p = .027$, showing that participants in the one-idea condition generated more original ideas than the first idea in the three-idea condition. Results for effectiveness scores showed a non-significant effect $F(1, 415) < 1$.

Only idea versus self-selected most creative idea. Results for originality and effectiveness scores revealed non-significant effect of the experimental condition, $F(1, 415) < 1$ $p = .90$; $F(1, 415) = 2.90$ $p = .08$, showing that participants in the one-idea condition generated ideas with similar scores on originality and effectiveness as compared to the most creative idea selected in the three-idea condition.

Only idea versus most creative idea as rated by judges. Results for originality and effectiveness scores revealed significant effect of the experimental condition, $F(1, 415) = 7.22$, $p = .007$; $F(1, 415) = 7.92$ $p = .005$, showing that participants in the three-idea condition generated ideas with higher scores on originality and effectiveness than the one idea generated in the one-idea condition.

Best selected idea versus the rated idea by judges. When analyzing the three-idea-condition, results of a pair-sample t-test showed that participants generated more original and effective ideas than what they thought they did, $t = 6.56$, $p < .001$; $t = 6.46$, $p < .001$. These findings showed that participants could have chosen an idea with higher originality and effectiveness scores than they did, indicating a suboptimal metacognitive decision.

Research question 2

In this section, we compared evaluations of candidate responses on originality, effectiveness, surprise, overall creativity, and probability of success across both conditions. Participants in the one-idea condition made the evaluations of their only idea. Participants in the three-idea condition made the evaluations of their self-selected most creative idea of the three they had generated. Results showed that participants in the three-idea condition felt that their idea was more original, effective, surprising, creative, and with a higher probability of success than participants in the one-idea condition, $F(1, 415) = 14.21, 49.90, 30.69, 23.03$, and 43.70 , p 's $< .001$ respectively (See Table 1 for means and standard deviations).

One tentative explanation is that participants in the three-idea condition felt better about their ideas because they had more ideas to support their evaluations (they had a larger pool of ideas, hence their selected idea must be original and effective, among other attributes) than participants in the one-idea condition. An interesting question from a metacognitive perspective is whether participants in the three-idea condition were aware that their best ideas might come after the initial one. To complete our analyses, we focused now on self-selection of the most creative idea versus what judges rated across the three ideas generated in the three-idea condition.

Research question 3

A chi-square test comparing the frequencies observed against what was expected by chance (33.3% because three ideas were generated) showed a significant effect, $\chi(2) = 38.52$, $p < .001$. 52.4% of participants chose the first idea as their most creative, which was significantly higher than the expected 33%.

We used a multilevel analysis approach because we had three assessments of ideas on originality and effectiveness over time. Multilevel modeling is well-suited to model this type of data structure (Geiser, 2013). To examine the trajectories, we conducted a random intercept and slope model with Mplus 7.11 (Geiser, 2013; two-level random option in Mplus). Examination of the trajectory of the originality and effectiveness scores, as rated by judges, with multilevel modeling, showed an interesting divergent pattern of results. Specifically, results for originality showed a significant, positive linear trajectory, $b = .187$, $p = .001$. Conversely, results for effectiveness showed a significant, negative linear trajectory, $b = -.23$, $p < .001$. The correlation between originality and effectiveness scores was negative, $b = -.443$, $p < .001$. This pattern of results showed that originality and effectiveness had different trajectories (See Figure 1), suggesting that some participants might have initially emphasized effectiveness over originality, leaving reporting of the most original but least effective idea to the end.

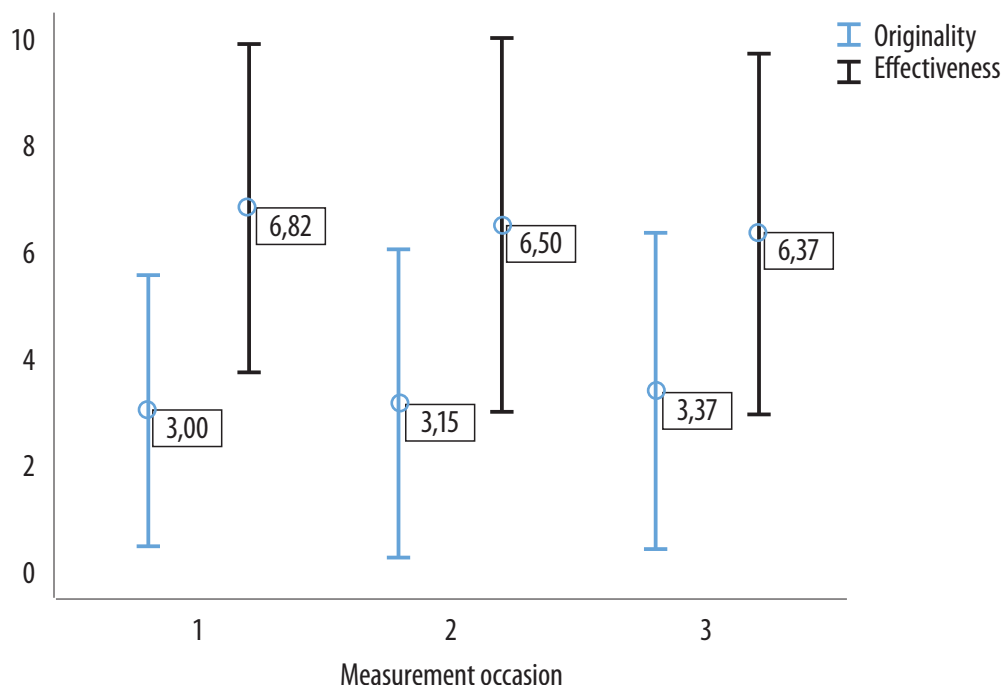


Fig. 1. Means for originality and effectiveness over time with two-standard-deviation bars

DISCUSSION

This article was organized around three research questions. The first two questions dealt directly with a widely used manipulation in social psychology: Asking participants to generate one versus three ideas. The third question dealt with the serial order effect and with how we conceptualized, operationalized, and measured creativity. We organized our discussion around the three research questions.

1) Are there differences in the originality, effectiveness, and overall creativity of ideas generated under the different requirements of asking individuals to generate one versus three ideas?

When only comparing the first idea in both conditions, the ideas generated in the one-idea condition had higher originality scores than the ideas generated in the three-idea condition. This finding could mean two things: 1) Participants in the one-idea condition focused on elaborating and making the most of this first idea, involving high-order executive processes (Beatty & Silvia, 2012). 2) Participants in the three-idea condition did not have to focus their efforts on their first idea because they knew they were required to generate three. Participants in the one-idea condition might have refrained from reporting some ideas that lacked originality, whereas participants in the three-idea condition did not have to because they had more chances. Our results were consistent with findings from previous studies (Reiter-Palmon & Arreola, 2015), in which participants were randomly assigned to generate one idea versus many ideas to solve a business problem. One implication is that if the priority is to generate an original idea with some degree of speed, individuals could focus on just generating one idea and not letting their minds contemplate other solutions explicitly. This type of decision is metacognitive because it involves implicit evaluation of ideas as well as regulation and control of the process of idea generation. Yet, when considering the entire pool of ideas, participants in the three-idea condition generated ideas with higher originality and effectiveness than participants in the one-idea condition, but they were not aware of this because they did not select, on average, the idea with their highest originality or effectiveness. We could argue that the decisions of participants in the three-idea condition were suboptimal because they could have chosen a business idea with greater originality and effectiveness than they did. This finding was consistent with previous studies as well (Reiter-Palmon & Arreola, 2015), indicating some degree of consistency.

The metacognitive feeling of ease of idea generation is an imperfect cue (see Efklides, 2006; Koriat et al., 2006) of mental processes. Individuals could monitor and report that it was easy (difficult) to generate ideas (Puente-Díaz, 2023). Participants did not report higher ease of idea generation in the one-idea condition than in the three-idea condition. At least two explanations are possible: 1) The experimental manipulation was not strong enough to generate differences. Participants in the three-idea condition did not perceive that the task was difficult. Future studies might compare the one-idea condition with a, for example, six-idea condition, seeking to tax cognitive resources. 2) Participants could not explain the differences based on a naïve theory of what greater

ease or difficulty could mean in terms of idea generation or a naïve theory that “generating three ideas should be a difficult task.” Hence, future studies should continue to examine the monitoring role of metacognitive feelings in the ideation process. Specifically, future studies could help understand how individuals interpret the ease or difficulty of generating a given number of ideas. The amount of ideas requested to be generated is not the main focus, but it is a manipulation that can shed light on how feelings inform control decisions (Puente-Díaz, 2023).

2) Do participants evaluate their chosen idea or their only generated idea better when asked to generate one versus three ideas?

Conceptualization of this question was similar to that for question 1, but it dealt with the evaluations of candidate responses by participants. Participants felt that their idea was more original, effective, surprising, creative, and with a higher probability of success in the three-idea condition than in the one-idea condition. One possible explanation is that participants in the three-idea condition felt better about their ideas because they were able to bring more information to mind and generate more information (Schwarz, 2004: declarative information), or because they were able to explore the problem space in greater depth. One last possibility is that participants in the three-idea condition were implicitly correct about their evaluations because they were able to generate other ideas with higher originality and effectiveness, among other aspects. Yet explicitly, they were not aware of this because they, on average, did not choose their most creative idea when they had the chance to do it. One practical implication is that participants would have been right to feel better about their chosen idea if they had selected their idea with the highest originality and effectiveness from their pool of three ideas. This represented a suboptimal decision.

3) Does the serial order effect, widely supported in creativity research (see Beaty & Silvia, 2012), hold when evaluating originality and effectiveness separately, or do the patterns diverge over time?

The third question involved the well-documented serial order effect, but conceptualized differently. Some creative tasks might encourage participants to focus more on originality, or effectiveness, or both. Our results showed an opposite, divergent pattern of results. While originality scores increased over time, from idea 1 to idea 3, effectiveness scores decreased, implying a divergent pattern between both dimensions. Conceptualization and measurement of originality and effectiveness separately, as opposed to providing an overall evaluation, is more common when scholars use applied creative problems as opposed to alternative-use type of tasks. To our knowledge, this divergent pattern of the serial order effect for originality and effectiveness has not been shown in previous studies. The divergent pattern suggested that the ideas did not meet both criteria over time. This finding is not entirely unexpected, given that business solutions often emphasize originality over effectiveness or vice versa. In addition, it is not entirely unexpected given that the goals of generating original and effective ideas are independent and ambiguous (Lynchfield, 2008). The work of Mueller and colleagues (2012) has explicitly explored when and why individuals might

favor effectiveness over originality, something known as the bias against creativity. Another possibility is that the type of problem used, opening a new business with low investment and expecting it to be a source of income, encouraged some participants to favor effectiveness over originality. A different task might have led to a different pattern of results.

LIMITATIONS

This study had several limitations. First, we used a manipulation coming from social psychology, asking participants to generate either one or three ideas. The conceptualization of said manipulation relies on metacognitive feelings or the amount of information brought to mind to explain differences between generating one versus three ideas. Regarding the first one, we did not find significant differences in metacognitive feelings, relying on the second explanation, namely the amount of information brought to mind to explain differences in the evaluations of candidate responses. Even though this second possibility is conceptually sound, we did not have a direct assessment of information brought to mind besides the apparently obvious assumption that participants brought more information to mind when asked to generate three versus one idea for opening a new business. Second, the conceptual development of creative metacognition has grown significantly in recent years (Lebuda & Benedek, 2023). Yet, compared to other areas such as metamemory (Dunlosky & Metcalfe, 2009), we still do not have enough conceptual predictions or empirical findings to test specific hypotheses (see Lebuda & Benedek, 2024, for a recent empirical study addressing this limitation). Hence, our approach was exploratory, asking relevant questions and subquestions coming from creative metacognition literature. Future conceptual developments should allow us to posit and test specific hypotheses testing different indicators of metacognitive control and monitoring, and how they influence creative performance (See Benedek & Lebuda, 2024, for a recent effort to test indicators of metacognitive control).

In sum, in one experiment with a large sample, we found that participants in the one-idea condition generated ideas with higher originality but only when compared to the first idea generated in the three-idea condition. When compared to the most original and effective idea generated, participants in the three-idea condition generated more original and effective ideas than participants in the one-idea condition. Similarly, participants in the three-idea condition felt that their selected idea was more original, effective, surprising, creative, and with a higher probability of success than that of the participants in the one-idea condition. Interestingly, even though participants in the three-idea condition generated more original and effective ideas, they were not aware of it on average. Last, for the particular problem of opening a new business, original scores increased over time, whereas effectiveness scores decreased.

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