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THE IMPACT OF SELF-CRITICISM THROUGHOUT THE CREATIVE PROCESS

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I dedicate this dissertation to my husband, Tyler. I love you. Thank you for everything.

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Abstract

Previous work on criticism and creativity suggests that people often critique their own work during creative efforts. While the role and importance of evaluating ideas has been established in the creativity literature, less is known about the impact of providing task-related self-critiques in earlier/mid creative process stages. Additionally, very few studies have sought to identify what attributes of self-criticisms are either helpful or hurtful during different stages of the creative process, and under certain conditions. In the present effort, an empirical examination of self-criticism attributes, self-criticism timing, and self-criticism context was conducted. Undergraduates were asked to take on the role of a marketing consultant and develop an advertising campaign for a failing company. During this task, participants provided task-related self-criticisms of their work during the problem definition, information gathering, concept selection, or concept combination stage of the creative process. Subsequently, they were asked to generate a list of ideas and a final plan for solving the marketing task. It was found that the impact of providing self-criticisms during certain creative process stages and under certain contexts depends on the characteristics of the criticism. Specifically, providing high-quality and complex self-criticisms during early-mid stages of the creative process (i.e., information gathering and concept selection) led to the highest levels of creative performance. Additionally, providing complex, practical, and deep criticisms under high levels of task complexity proved important.

Keywords: creative thought, self-criticism, creative processes

Introduction

The nature of problems that call for creative solutions have inherent characteristics that make the process of solving them difficult, complex, and prone to flaw. Specifically, problems calling for creativity are ill-defined, novel, and extremely complex (Mumford & Gustafson, 1988; 2007). For this reason, it can be difficult to fully understand or define such ill-structured problems, let alone generate viable solutions to them. Moreover, given the ambiguous nature of problems calling for creativity, many different issues, concepts, and ideas might be considered, paving the way for multiple unique solutions or paths of action. In fact, this phenomenon has provided the basis for much of the work on divergent thinking (e.g., Guilford, 1970), or the process of generating multiple possible outcomes or solutions to issues; an ability long-recognized to enhance creative performance (Vincent et al., 2002; Runco & Acar, 2012).

However, while multiple concepts and ideas can arise during creative efforts, not all can be pursued, nor are they all equal in viability or relevance (Martin, Elliot, & Mumford, 2019; Licuanan, Dailey, & Mumford, 2007). For this reason, people must use strategies to select the most viable information, concepts, and ideas when solving creative problems. One well-known strategy is idea evaluation, or the critical evaluation of ideas with respect to specific goals, standards, or constraints (Mumford et al., 1991). Indeed, substantial evidence has been accrued that suggests that idea evaluation is a crucial process in creative problem-solving efforts. Specifically, evaluating ideas after they have been generated with respect to certain factors such as standards, goals, and constraints can enhance the viability of problem solutions (Runco & Vega, 1990; Mumford, Lonergan, & Scott, 2002; Lonergan, Scott, & Mumford, 2004; Licuanan, Dailey, & Mumford, 2007; Blair & Mumford, 2007). Idea evaluation can also help individuals narrow down the list of potential solutions to facilitate more actionable plans for innovation.

Specifically, idea evaluation is often required to decide which ideas to eliminate, revise, and/or pursue.

It is important to note that critical evaluation is a cognitive process which involves forecasting potential outcomes of implementing ideas and appraising ideas in relation to relevant standards, situational constraints, and requirements (Mumford et al. 2002; Lonergan et al., 2004; Blaire & Mumford, 2007). Put differently, idea evaluation is an active critical thinking process that implies that individuals must critique ideas or work to some extent during creative efforts (Mumford & Fichtel, 2020). Specifically, when people work with information, concepts, and ideas during the creative process, it is implied that they engage in some form of constructive criticism when determining the viability of information, ideas, or plans.

Such evaluative critiques can come from multiple sources (Runco & Smith, 1992). For example, critiques can occur both internally (i.e., evaluating one's own ideas) and externally (i.e., someone else evaluates another's ideas). And while both internal and external evaluation likely play a role in creative productivity, most extant research has focused on the role of evaluating others' ideas (e.g., external evaluation) (e.g., Gibson & Mumford, 2013; Dailey & Mumford, 2006) during the creative process, rather than providing constructive critiques toward one's own work. This is unfortunate, because during creative efforts, creators must evaluate their own ideas, information, and options to progress (Runco & Smith 1992). Without evaluation, how are individuals to decide which information, ideas, and concepts to move forward with? This issue is especially important considering the aforementioned critical role of divergent thinking in the creative process (e.g., Runco & Acar, 2012). Additionally, creativity studies on internal evaluation (i.e., evaluating one's own ideas) have been generally limited to generative creative processes (e.g., idea generation) (e.g., McIntosh et al., 2021; Runco & Smith, 1992). However, it

has been widely established that creativity also involves several other earlier processes such as problem definition, information gathering, and selecting concepts to pursue (Mumford et al., 1991). Thus, it is important to explore when, and under what conditions task-related self-critiques contribute to creative performance.

A primary goal of the present effort is to explore the impact of constructive self-criticism on creative performance throughout different stages of the creative process. For example, at which stage in the creative process may critiquing one's own work help or hurt performance? Furthermore, the present effort also seeks to identify the attributes of self-critiques that may be more or less useful. The impact of providing self-criticisms under different task conditions will also be examined. First, an overview of the criticism literature as it relates to creativity is provided. Subsequently, the potential role of self-criticism during various stages of the creative process and under certain conditions will be identified, discussed, and examined via an experimental study using a creative marketing task.

Criticism

In light of the accumulating evidence that the evaluation of ideas is an important facet of creative thought, researchers have begun to examine the nature and impact of criticisms in relation to creativity. In a historiometric study of Beethoven, Kozbelt (2017) found that Beethoven was an "astute" self-critic. Even more importantly, it appears that Beethoven's self-criticisms enhanced, rather than hindered his creative performance. For example, Beethoven's self-criticisms were positively related to documented listening hours, expert ratings, number of recordings of a piece. Similarly, several other case studies of artists reveal that many creative products are a result of lengthy periods of revision (Csikszentmihalyi, 1996; Graham & Harris, 1994).

Along somewhat related lines, other research suggests that several cognitive processes often involved in constructively critiquing one's own work such as forecasting downstream implications of an idea (McIntosh et al., 2021) and active analysis of idea originality and interactional processes (Licuanan, Dailey, & Mumford, 2007), positively contribute to creative performance. Moreover, Martin et al. (2019) found that extensive identification, deliberation and remediation of errors during the creative process led to more original creative problem solutions. Taken together, extant research suggests that certain types of task-oriented, constructive self-criticism can enhance creative performance.

Attributes of Self-Criticism

Of course, the characteristics of self-criticisms can differ greatly. This is important to note because criticism attributes likely play significant a role in determining how they ultimately impact creative performance. For example, Gibson and Mumford (2013) asked undergraduates to produce advertising campaigns for a marketing problem where solutions were appraised for creativity. Prior to their campaign task, participants were given a set of candidate ideas that they were asked to critique. It was found that more creative solutions were provided when participants gave more thorough, deep criticisms. These findings are interesting because they not only point to the potentially positive impact of criticism on creativity, but also demonstrate that the characteristics, or attributes of criticisms provided likely determine how useful the criticism will be. Along somewhat related lines, Lonergan et al. (2004) found that applying different appraisal standards (e.g., operative standards, innovative standards) when evaluating creative ideas led to different outcomes depending on the standards used. Taken together, these findings suggest that it is important to consider the attributes of criticisms when examining their impact on creative performance. And, while the aforementioned studies focused on critiquing the ideas of others,

the findings likely extend to criticizing one's own work. Specifically, self-criticisms evidencing certain attributes might be more impactful than others on creative performance. For example, high quality criticisms that are coherent and relevant may enhance creative performance, while lower quality criticisms that do not address key issues in a coherent way may hurt creative performance. Thus, a hypothesis is indicated.

H1: The impact of self-criticism on creative performance will differ according to the attributes of the self-criticism.

Self-Criticism Throughout the Creative Process

To date, much of the experimental work on self-evaluation, or self-criticism and creativity has been limited to the examination of generative processes (i.e., idea generation) (e.g., McIntosh et al., 2021). However, creativity is now widely conceptualized as a process consisting of multiple stages, not solely the generation of ideas. That is, there is ample evidence suggesting that people must first engage in other processes before they generate final ideas or solutions to problems calling for creativity (e.g., Mumford et al., 1991; Mumford, Medeiros, & Partlow, 2012). These processes include problem definition (Reiter-Paulmon & Robsinon, 2009; Mumford et al., 1991), information gathering (Mumford et al., 1997), concept selection (Mumford et al., 1996; Davidson & Stenberg, 1984), and conceptual combination (Finke, Ward, & Smith, 1992; Baughman & Mumford, 1995; Ward, Patterson, & Sifonis, 2004).

While there is substantial evidence pointing to the importance of critical evaluation of ideas generated (e.g., Gibson & Mumford, 2013; Licuanan et al., 2007; Lonergan et al., 2004), less is known about how self-evaluation, or task-oriented self-criticism during various stages of the creative process influences creative performance. Specifically, no work to date has examined how the presence of self-criticisms during early/mid stages of the creative process (i.e., problem

definition, information gathering, concept selection, and conceptual combination) influence the quality of ideas generated and final problem solutions. This is unfortunate, because it is unlikely that idea generation is the only stage in the creative process that is influenced (that is, enhanced or inhibited) by task-oriented self-criticism. This may be especially true because each creative process stage that occurs before idea generation (i.e., problem definition, information gathering, concept selection, and conceptual combination) involve cognitive processes that are equally fallible to error. For example, during problem definition individuals may fail to consider and integrate all relevant goals, procedures, and challenges relevant to the problem. Similarly, while selecting concepts, individuals may place too much or too little weight to certain conceptual categories such as stakeholder groups, standards, and objectives. More broadly, the proper execution of any stage of the creative process is likely dependent on key variables one may or may not fail to consider and successfully address.

Clearly, mistakes can happen at any time during the creative process. As a result, it could be important to evaluate one's own work long before final ideas have been generated. Thus, it is critical to explore the potential impact of critiquing one's own work during different stages of the creative process that occur before the generation of final ideas. On one hand, it is possible that the later the stage of the creative process, the more difficult it becomes to provide and integrate viable critiques, since many resources could have already been invested. Along somewhat related lines, research on creative teams suggests that interpersonal critiques regarding tasks are more valuable in earlier, as opposed to later stages of a creative effort, before too much time and resources has been invested in an idea(s) (Farh, Lee, & Farh, 2010). However, it has yet to be understood if this would extend to critiquing one's own work.

On the other hand, it could be argued that critiquing one's own work in earlier stages of the creative process could inhibit creative performance. Duval and Silvia (2002) argue that by enabling people to recognize the possibility of failing, self-criticism can make people defensive and disrupt task performance via several self-serving biases. Additionally, others have used theories of divergent thinking to argue that because generating creative ideas results from expansive cognitive processes, focusing on one's own performance may disrupt or impede range of thought and harm creative performance (Runco, 1991). Thus, earlier critiques could prematurely restrict or narrow key concepts or information bearing on an issue such that concepts, goals, problems, and other information truly relevant to the creative effort are weeded out too early. Therefore, it is unclear whether early-process criticisms enhance creative performance by allowing one to weed out less viable problems/concepts/objectives and identify and refine good ones or inhibit creative performance by disrupting range of thought too soon. Hence, a research question is indicated.

RQ1: Does the impact of self-criticisms on creative performance differ according to the stage in the creative process in which it was provided?

Additionally, it could be that providing certain types of criticisms, such as criticisms that consider a wide range of issues, or the complex relationships among issues, are particularly useful in earlier creative process stages because they are more likely to enhance one's range of thought, which may be conducive to divergent thinking relevant to the problem. Additionally, deep and operant criticisms could be more useful in later stages such as conceptual combination because it better prepares individuals to think deeply about combining concepts in novel ways and considering how different combinations may be more or less feasibly implemented. It could

also be that certain criticism attributes, such as criticism quality are equally important across all stages of the creative process and are not stage specific.

RQ2: Do the attributes of self-criticisms impact the relationship between criticism stage and creative performance?

Task Complexity

Because creative problem solving does not occur in a vacuum, it is important to consider task context when examining creative performance and its related processes. Task context may be especially important to consider when examining the impact of self-criticism on creativity. For instance, Lonergan et al. (2004) found that applying different appraisal standards (e.g., operative, innovative) when evaluating ideas can lead to different outcomes depending on the task context. These findings are interesting because they suggest that both the type of criticism, and the context in which it occurs matters for creative performance.

One especially noteworthy contextual variable to consider is task complexity. Extant research suggests that higher levels of task complexity can hinder creative performance because it becomes more difficult to execute the processes involved in creative thinking (e.g., Mumford, Baughman, et al., 1996; Marcy & Mumford, 2010). More centrally, task complexity may be especially important to consider when examining the impact of self-criticism attributes and self-criticism timing on creative performance. Gibson and Mumford (2013) found that critiques to candidate ideas to solve creative problems were less effective and viable under high levels of task complexity. Additionally, a study of idea evaluation and creativity found that less viable idea evaluations were produced under higher conditions of complexity opposed to less (Dailey & Mumford, 2006).

These studies taken together suggest that it may be more difficult to produce both viable critiques and higher quality creative solutions under high levels of task complexity. Thus, for critiques to be useful under conditions of high complexity, criticisms themselves may need to exhibit certain attributes. For example, criticisms that are more complex (i.e., account for relationships and interactions among issues) may, in fact, be more useful for solving complex problems. Additionally, it could be that critiques that consider a higher range, as opposed to a lower range of issues are more useful for solving problems under high levels of task complexity because it helps individuals make sense of numerous pieces of information. At the same time, criticisms that consider a larger range of issues and the complex relationships among those issues may add more difficulty to solving an already complicated problem. Thus, the following research question is posed:

RQ3: What are the attributes of self-criticisms that impact creative performance under conditions of task complexity?

Method

Sample

The sample consisted of 201 undergraduates drawn from a large southwestern university. The 81% women and 19% men who agreed to participate were recruited from undergraduate psychology classes that provided class credit for participation in research studies. Participants selected studies from a website that provided a brief, one paragraph description of studies that were available. The average age of the participants who agreed to participate in the study was 18 (M = 18, SD = .93). Moreover, participants' average GPA was 3.62 and ACT score was 25.5.

General Procedures

Participants were recruited to participate in what was said to be a study about self-feedback and problem solving for a marketing campaign. The study was two and a half hours in length and was conducted on Qualtrics. For the first portion of the study, participants filled out a series of timed covariate measures after filling out a written consent form. Following completion of the timed covariates, participants were presented with a marketing task where they were asked to take on the role of a newly hired marketing consultant for a failing root beer company. Before working on the marketing task, participants were provided with a series of emails describing both the products and the company's current situation. Participants were able to read this information at their own pace. Subsequently, participants were asked to complete a series of tasks intended to measure four creative processes—problem identification, information gathering, concept selection, and conceptual combination. After completing earlier /mid creative stage tasks, participants were asked to generate a final set of ideas and then a detailed plan of their final marketing proposal. Participants had unlimited time to complete this marketing task, which took about 70 minutes to complete. After completion of the marketing task, participants completed a series of untimed covariate measures and filled out demographic information. Finally, participants were debriefed.

Experimental Task

The impact of self-criticism attribute, stage, and task context was examined using a low-fidelity simulation exercise (Motowidlo, Dunnette, & Carter, 1990) drawn from prior work by Hester et al. (2012). During this task, participants were asked to take on the role of a marketing consultant for a failing root beer company named "Frosty Mug Brewing co." , where they were to develop a marketing campaign for a new product. First, participants were given a series of emails informing them that they would be taking on the role of a marketing consultant and were

provided with a series of documents including information about the company history, products, and the current situation of the company. Next, they received an email from the advertising director providing a description of the new product, a high energy root beer, that they would be developing a marketing campaign for. For example, they were told the name, characteristics, price, and target market of the new high-energy product. Participants were also made aware of specific company concerns to keep in mind when developing the campaign. For instance, they were told to "please maintain the classic positive image of Frosty Mug products while still targeting the 15 - 25 demographic and their on-the-go lifestyle".

After receiving information about the company and their task, participants were then asked to work through each creative process stage in relation to the marketing task. Beginning with problem definition, participants were asked to "please put into your own words the problems being faced by Frosty Mug—specifically, list any goals, procedures, constraints, and any other information/questions/key challenges relevant to identify and solve the problem." Next, participants were asked to gather information from a prompt that stated "now that you are done defining the problem, we are asking that you list the key information you think is relevant to the success of Frosty Mug Brewing Co. This may include goals, procedures, constraints, outcomes, and key steps relevant to solving the problem. Additionally, list any information that you think is inconsistent, and/or less relevant to the task at hand."

Subsequently, participants were prompted to engage in concept selection from an email stating "please list the key concepts derived from the previous information you gathered to be considered. This may include critical factors for creating a successful marketing campaign, such as key constraints that may make the marketing plan not work, long-term goals, key customer groups, employee groups, standards to be applied, etc." Finally, participants were asked to

engage in conceptual combination via an email received from executives stating three top-of-mind elements to integrate into the marketing campaign. These elements included product appearance, use of social media, and maintaining a positive image. Participants then received an email stating "please create some idea(s) that incorporate ALL of the executive ideas while taking into consideration key concepts you selected in the previous stage." After engaging in concept combination, participants were asked to generate a final list of ideas, and then subsequently develop a final plan on how to increase sales and customer interest for the high-energy root beer product. Some evidence for the construct validity of this task for measuring creative performance was provided by positive correlations between performance on the task and divergent thinking ($r \cong .27$), planning skill ($r \cong .20$), and intelligence ($r \cong .16$)—skills and abilities that are strongly related to creative thinking (Sternberg, Kaufman, & Roberts, 2019; Runco & Acar, 2019; Mumford et al., 2017).

Design and Manipulations

The study was a 2 x 4 design, where task complexity (high/low) and the stage in which self-criticisms were provided (problem definition, information gathering, concept selection, concept combination) were manipulated.

Complexity. Task complexity was manipulated by presenting participants with an additional one page summary of a customer and competitor market report. In this report, customer information included age, gender, education, income, location, and interests. In this report participants were also presented with a list of competitor companies.

Criticism stage. The second experimental manipulation was the stage in the creative process in which participants provided task-related self-criticisms. That is, participants were asked to critique their own responses during problem definition, information gathering, concept

selection, or conceptual combination. To manipulate self-criticism, participants received an email immediately following their completion of either the problem definition, information gathering, concept selection, or conceptual combination stage of the creative process. This email included an example of critiques followed by a probe question to induce task-oriented critiques of their own work in a particular creative process stage. Specifically, participants were first provided with an example of how critiques should be conducted at the company. This example was intended to help structure participant responses and give participants permission to criticize their own work (Gibson & Mumford, 2013). The example critique presented a problem "how to entertain children and their parents at a birthday party" and three candidate solution ideas: have a party at a pool, rent a bouncing castle, and hire a clown. For each of the candidate ideas, three to four example critiques were provided. For example, in the case of having a party at a pool, four critiques were presented: (1) did not consider time of year—it may be too cold for a pool party, (2) there is a potential to cause injury, (3) this will probably require a supervisor (parent or staff), (4) must consider cost constraints. After participants were given an example of a critique applied to an unrelated scenario, they were asked to critique their own response to the task. For example, if they were in the problem definition critique condition, they were given the following prompt: "now that you have read an example of how to critique a response, please critique 4-7 aspects of your response to 'problem definition' below." Once participants completed their critiques, they proceeded through subsequent stages of the creative process, followed by the generation of ideas, and a written final plan.

Individual Difference Measures

Verbal intelligence. Intelligence has been shown to influence performance on creative problem solving tasks (Vincent, Decker, & Mumford, 2002). Thus, a measure of verbal

intelligence was included in the present study. To measure verbal intelligence, participants were asked to complete a 30-item verbal reasoning scale from the Employee Aptitude Survey (EAS), where each item presents a set of five facts bearing on a problem. People are asked to indicate whether each of the five potential conclusions drawn from these facts is true, false, or uncertain. The measure yields retest reliabilities above .80**.** Evidence for the validity of this measure has been provided by Ruch and Stang (2005).

Divergent thinking. To measure divergent thinking, an ability strongly related to creative performance (e.g., Vincent et al., 2002), participants were asked to complete Merrifield, Guilford, Christensen, and Frick's (1962) Consequences measure. In this measure, participants are presented with five unlikely events, and are then asked to list as many potential consequences as possible to said events in a span of 10 minutes. When scored for number of ideas generated, or fluency, the internal consistency of this measure is above .70. For evidence of the construct validity of this measure, see Merrifield, Guilford, Christensen, and Frick (1962) and Vincent, Decker, and Mumford (2002).

Task expertise. Because domain task expertise can influence performance on creative tasks (Vincent, Decker, & Mumford, 2002), marketing expertise was measured. To measure participants' levels of task expertise, participants were presented with six life history, or background data questions (Mumford, Barret, & Hester, 2012), which was given during the untimed final portion of the study. This task expertise measure was adapted from procedures used by Lonergan et al. (2004) and Gibson and Mumford (2013), and examined participants' previous exposure to (e.g., how often did your primary caregivers discuss advertisements at home?) and interest in (e.g., how often do you think about current advertisements and marketing trends in commercials, magazines, etc.?) marketing issues. Participants indicated their frequency

and strength of the behavior on a five-point Likert scale. The internal consistency of this measure is above .70. Furthermore, see Lonergan et al. (2004) and Gibson and Mumford (2013) for more evidence of the validity of this measure.

Need for cognition. Watts, Steel, and Song (2017) found that the extent to which people are willing to think deeply, or their need for cognition, influences creative problem solving. Therefore, participants completed Cacioppo, Petty, and Kao's (1984) 18-item measure of need for cognition. In this measure, people are asked to rate the extent to which they engage in cognitively demanding tasks. For example, participants are asked to rate the extent to which "I prefer complex problems to simple problems" and "I find satisfaction in deliberating hard and for long hours". The internal consistency of this scale is above .80. Moreover, Cacioppo and Petty (1982) and Cacioppo, Petty, Feinstein, and Jarvis (1996) have provided evidence for the construct validity of this measure.

Planning skill. Because the final marketing task required the generation of a final plan, Marta, Leritz, and Mumford's (2005) measure of planning skill was included. In this measure, participants are asked to read several business scenarios that each reflect a key planning skill (e.g., consideration of the causes of outcomes). Participants were presented with 6-12 potential responses per question and prompted to choose 3-4 of those potential responses, which were scored for the effective use of planning skills. Split-half reliabilities for this planning measure are around .80, and evidence for the validity of this planning measure can be seen in Marta et al. (2005).

Personality. Finally, participants were asked to complete a global personality measure. Costa and Mcrae's (1989) NEO Five Factor inventory was used to measure openness, agreeableness, neuroticism, conscientiousness, and extraversion. In this measure, 60 items are

presented that ask participants to rate on a five-point scale the extent to which they agree with statements such as “I often try new and foreign foods” and “I rarely feel fearful or anxious”.

Rater Training

Criticism attributes and creative performance (i.e., idea generation and final plans) were appraised by three trained doctoral candidate judges, all familiar with the creativity literature. First, judges met for an hour long frame-of-reference training where they were provided with materials to get familiar with both the experimental task and the benchmark anchored five-point rating scales for each variable. After the initial training, judges were asked to practice on a set of 10 participant responses and then met shortly after to discuss any differences in their ratings. Once judges were familiarized with the ratings scales and tasks, they began rating participant criticism attributes, as well as ideas generated and final plans to the marketing task. Judges met regularly to discuss any rating discrepancies with respect to the anchored rating scales and rating procedures. The interrater agreement coefficients obtained for all variables rated were above .70.

Appraisals of Self-Criticism Attributes

To appraise the attributes of the self-criticisms, the three judges were asked to evaluate all criticisms provided by participants. Ratings were conducted on five-point benchmark anchored rating scales, which provide more reliability and accuracy when evaluating creative performance (Redmond, Mumford, & Teach, 1993). Specifically benchmark rating scales were used to score criticisms with respect to (1) depth, the thoroughness and insightfulness of critiques; (2) range, the number of different issues considered in critiques; (3) complexity, the extent to which there are interactions or interrelationships among critiques; (4) specificity, the extent to which critiques focus on specific, as opposed to more general concerns; (5) operationalism, the extent to which critiques are focused on the actual execution of information,

concepts, and/or ideas; (6) usefulness, the extent to which the critique focuses on practical issues that are relevant to solving the problem. Additionally, an overall criticism quality variable was created by aggregating all six criticism attributes (α = .90). The criticism attributes rated were chosen based on previous studies that examined criticisms and creativity (e.g., Gibson & Mumford, 2013) as well as idea evaluation and error management (e.g., Lonergan et al., 2004; Medeiros, Partlow, & Mumford, 2014; Runco, 2013; Robledo et al., 2012). See Figure 1 for an example rating scale for criticism depth. The interrater agreement coefficients obtained for the six criticism attribute dimensions were sufficient: depth (r_{wg} = .81), range (r_{wg} = .82), complexity (r_{wg} = .79), specificity (r_{wg} = .80), operationalism (r_{wg} = .75), usefulness (r_{wg} = .74).

Insert Figure 1 about here

Appraisals of Creative Problem Solving Performance

Again, three trained doctoral students familiar with the creativity literature appraised final ideas generated and final problem solutions. Ideas generated were objectively coded for number of ideas, and rated on a 5-point scale for flexibility, quality, and originality and final plans were rated for quality, originality, and elegance (Besemer & O'Quin, 1999; Christiaans, 2002; Runco, 1986). Flexibility was defined as the number of idea categories or themes (actual uniqueness of ideas) provided. Quality was defined as the extent to which responses were complete, coherent, and useful. Originality was defined as the extent to which responses were novel and unexpected. Elegance was defined as the extent to which a response was arranged in a succinct, refined, and clever way. Interrater agreement coefficients for idea generation flexibility, quality, and

originality were .76, .83 and .85. Additionally, the interrater agreement coefficients were acceptable for final plan quality, originality, and elegance were .81, .76, and .81. See Figures 2 and 3 for example rating scales of idea generation and final plan performance criteria.

Insert Figures 2 and 3 about here

Analyses

Initially the means, standard deviations, and correlations were obtained to examine initial relationships between individual difference variables, criticism attributes and creative performance dependent variables. Next, a series of regressions were conducted where idea generation number, flexibility, quality, and originality, as well as final plan quality, originality, and elegance were regressed on criticism quality with relevant covariates to examine the specific impact of the criticism quality aggregate as a continuous variable on creative performance. Subsequently, ANCOVAs were conducted to examine the main effects and interactions of self-criticism timing, task complexity, self-criticism attributes on creative performance. A median split was used on criticism attribute variables for the ANCOVA analyses. For both regressions and ANCOVAs, covariates significant at the $p \leq .05$ level were retained.

Results

Table 1 provides means, standard deviations, and correlations among creative performance, criticism attribute dimensions, task complexity and individual difference variables. First, it is important to note that some evidence for the construct validity the creative performance task used was provided by positive correlations between divergent thinking, a critical skill predicting creative thought (Runco & Acar, 2012), and all creative performance

variables on the task ($r \cong .27$). Additionally planning skill, another skill related to higher levels of creative performance (Mumford et al., 2017), was positively correlated with idea generation flexibility ($r = .15$, $p \leq .05$), quality ($r = .15$, $p \leq .05$), originality ($r = .21$, $p \leq .01$) and final plan quality ($r = .19$, $p \leq .01$), originality ($r = .28$, $p \leq .01$) and elegance ($r = .21$, $p \leq .01$). Evidence for the construct validity of the task was also provided via the positive relationship between intelligence (Sternberg, Kaufman, & Roberts, 2019) and final plan quality ($r = .14$, $p \leq .05$) and originality ($r = .17$, $p \leq 05$). It is also interesting to note that neuroticism was negatively related to final plan originality ($r = -.20$, $p \leq .01$).

As can be seen, the overall quality of self-criticisms was positively correlated with creative performance. Specifically, criticism quality was positively related to a larger number of ideas generated ($r = .22$, $p \leq .01$), more flexible ideas ($r = .34$, $p \leq .01$), higher quality ideas ($r = .45$, $p \leq .01$), and more original ideas ($r = .41$, $p \leq .01$). Similarly, higher quality criticisms were positively associated with higher quality ($r = .41$, $p \leq .01$), more original ($r = .39$, $p \leq .01$), and more elegant ($r = .45$, $p \leq .01$) final plans. It also appears that specific self-criticism attributes such as depth, range, complexity, specificality, operationalism, and usefulness are all positively associated with most dimensions of creative performance.

Insert Table 1 about here

Regressions

As can be seen in Table 2 and Table 3, the findings obtained from the correlation analyses were confirmed by regressing creative performance (e.g., idea generation and final plans) on overall criticism quality with relevant covariates. Specifically, even after controlling

for relevant individual differences variables such as divergent thinking, planning skill, and personality, self-criticism quality had a strong positive relationship with all creative performance criteria. For example, number of ideas generated ($\beta = .16$, $p \leq .05$), idea flexibility ($\beta = .32$, $p \leq .01$), quality ($\beta = .42$, $p \leq .01$), and originality ($\beta = .37$, $p \leq .01$), as well as final plan quality ($\beta = .37$, $p \leq .01$), originality ($\beta = .30$, $p \leq .01$), and elegance ($\beta = .41$, $p \leq .01$) were all positively related to higher levels of criticism quality. Clearly, when self-criticisms are provided during creative efforts, criticism quality matters, above and beyond divergent thinking, planning skill, and personality.

Insert Tables 2 and 3 about here

ANCOVAs

ANCOVA results for self-criticism attributes (median split), criticism stage, and task complexity on idea generation number, flexibility, quality, and originality, as well as final plan quality, originality, and elegance are presented in tables 4 through 7. Mirroring the regression results, criticism quality had a significant and positive main effect on both idea generation and final plan performance. Additionally, there were several main effects of specific criticism attributes discussed below. There were no significant main effects of criticism stage or task complexity. However, there were significant interactions between certain criticism attributes and the creative process stages in which they were produced (i.e., the timing of the criticisms). Thus, the impact of providing self-criticisms during certain stages of the creative process appears to depend on the characteristics of said criticisms. Additionally, there were significant interactions

between criticism attributes and task complexity. Apparently, for criticisms to be the most useful under complex conditions, they need to exhibit certain characteristics.

Insert Tables 4 through 7 about here

Self-criticism quality. Criticism quality had a significant and positive main effect on idea generation number $F(1, 183) = 5.17$, $p \leq .05$, flexibility $F(1, 183) = 12.67$, $p \leq .01$, quality $F(1, 183) = 24.34$, $p \leq .01$, and originality $F(1, 183) = 20.62$, $p \leq .01$. Additionally, criticism quality had a significant main effect on final plan quality $F(1, 183) = 16.63$, $p \leq .01$, originality $F(1, 183) = 15.81$, $p \leq .01$, and elegance $F(1, 183) = 17.11$, $p \leq .01$. There was a significant interaction $F(1, 3) = 2.77$, $p \leq .05$ between criticism quality and criticism stage on plan originality. While providing quality criticisms across all stages of the creative process appeared useful, providing quality criticisms during the concept selection stage seems especially important. Inspection of the cell means indicated that during concept selection, high quality criticisms ($M = 3.11$, $SE = .12$) led to the most original final plans. In contrast, the least original final plans were produced when low quality criticisms ($M = 2.17$, $SE = .17$) were provided in the very same stage (i.e., concept selection). Apparently, if one decides to critique their own work during concept selection, it is crucial that their self-criticisms are high quality. Providing low-quality criticisms during concept selection appears worse for creative performance than providing low quality criticisms in any other creative process stage.

Self-criticism complexity. There was a main effect of criticism complexity on idea generation quality $F(1, 183) = 9.58$, $p \leq .01$ and originality $F(1, 183) = 7.30$, $p \leq .01$ in that more

complex criticisms, as opposed to less complex criticisms led to higher quality (M = 2.56, SE =.06 vs. M = 2.27, SE = .07) and more original ideas (M = 2.95, SE = .08 vs. M = 2.61, SE = .09). Additionally, there were significant interaction effects between criticism complexity and criticism stage on originality of ideas generated $F(3, 184) = 2.60$, $p \leq .05$, number of ideas generated $F(3, 184) = 2.76$, $p \leq .05$, final plan quality $F(3, 183) = 4.15$, $p \leq .01$, and final plan originality $F(3, 183) = 4.72$, $p \leq .01$.

Across each of the creative performance criteria, the highest performance occurred when people provided complex criticisms during the information gathering stage. It seems that providing complex, interrelated critiques during the information gathering phase helps produce more original ideas (M = 3.10, SE = .16), a larger number of ideas (M = 5.70, SE = .46), as well as higher quality (M = 3.10, SE = .13) and more original (M = 3.08, SE = .13) final plans. In contrast, participants performed the worst when they provided less complex critiques during the concept selection phase of the creative process. It appears that providing less complex critiques during the concept section phase thwarts idea originality (M = 2.26, SE = .21), leads to the lowest number of ideas generated (M = 3.71, SE = .60), and reduces both final plan quality (M = 2.43, SE = .17) and originality (M = 2.34, SE = .17).

There was also a significant interaction between criticism complexity and task complexity on final plan originality $F(3, 183) = 7.71$, $p \leq .01$. Inspection of the cell means suggests that under conditions of task complexity, providing more complex criticisms, as opposed to less complex criticisms results in more original final plans (M = 3.01, SE = .10. vs. M = 2.56, SE = .11). When solving more complicated problems, it makes sense that providing self-criticisms that reflect the complexity of the task are more helpful than criticisms that do not account for such complexity.

Self-criticism range. Significant main effects were observed for criticism range on idea generation quality $F(1, 183) = 5.29$, $p \leq .05$, final plan quality $F(1, 183) = 10.44$, $p \leq .01$, originality $F(1, 183) = 6.54$, $p \leq .01$, and elegance $F(1, 183) = 13.30$, $p \leq .01$. The cell means indicated that when participants cover a wider, as opposed to lower range of issues in their criticisms, idea quality ($M = 2.50$, $SE = .05$ vs. $M = 2.22$, $SE = .11$), final plan quality ($M = 2.93$, $SE = .05$ vs. $M = 2.50$, $SE = .12$), originality ($M = 2.85$, $SE = .06$ vs. $M = 2.50$, $SE = .13$), and elegance ($M = 2.83$, $SE = .05$ vs. $M = 2.39$, $SE = .11$) were higher.

Self-criticism depth. There was a significant main effect of criticism depth on idea flexibility $F(1, 183) = 4.40$, $p \leq .05$, idea quality $F(1, 183) = 10.31$, $p \leq .01$, idea originality $F(1, 183) = 11.66$, $p \leq .01$, and final plan elegance $F(1, 183) = 4.87$, $p \leq .05$ in that participants who provided deeper, as opposed to less deep criticisms had more flexible ideas ($M = 2.84$, $SE = .09$ vs. $M = 2.56$, $SE = .10$), higher quality ideas ($M = 2.57$, $SE = .06$ vs. $M = 2.27$, $SE = .07$), more original ideas ($M = 3.01$, $SE = .08$ vs. $M = 2.58$, $SE = .10$), and elegant plans ($M = 2.82$, $SE = .06$ vs. $M = 2.61$, $SE = .07$). There was also a significant interaction between criticism depth and task complexity on final plan originality $F(1, 182) = 3.84$, $p \leq .05$. That is, more original plans were produced when deeper, as opposed to less deep ($M = 3.03$, $SE = .10$ vs. $M = 2.63$, $SE = .11$) criticisms were provided under high levels of task complexity. It seems that providing deep criticisms could aid individuals in working through complex tasks.

Self-criticism usefulness. A significant main effect was observed for criticism usefulness on number if ideas generated $F(1, 182) = 7.79$, $p \leq .01$, idea flexibility $F(1, 182) = 10.96$, $p \leq .01$, idea quality $F(1, 182) = 31.40$, $p \leq .01$, and idea originality $F(1, 182) = 21.43$, $p \leq .01$, as well as final plan quality $F(1, 182) = 16.00$, $p \leq .01$, originality $F(1, 182) = 16.01$, $p \leq .01$, and elegance $F(1, 182) = 14.12$, $p \leq .01$. Specifically, more useful as opposed to less useful self-criticisms

were associated with a higher number of ideas generated (M = 5.24, SE = .25 vs. M = 4.24, SE = .26), more flexible ideas (M = 2.94, SE = .09 vs. M = 2.52, SE = .09), higher quality ideas (M = 2.68, SE = .06 vs. M = 2.19, SE = .06), more original ideas (M = 3.08, SE = .08 vs. M = 2.52, SE = .08), as well as higher quality (M = 3.03, SE = .07 vs. M = 2.62, SE = .07), more original (M = 2.98, SE = .07 vs. M = 2.55, SE = .08), and more elegant (M = 2.89, SE = .06 vs. M = 2.55, SE = .07) final plans. Additionally, there was a significant interaction effect between criticism usefulness and task complexity on final plan quality $F(1, 182) = 6.31$, $p \leq .05$ and originality $F(1, 182) = 3.90$, $p \leq .05$. When participants provided practical, highly relevant, and actionable (i.e., useful), as opposed to less useful critiques under task complexity, final plan quality (M = 3.22, SE = .09 vs. M = 2.57, SE = .09), and originality were higher (M = 3.16, SE = .10 vs. M = 2.53, SE = .10).

Self-criticism specificity. There was a significant main effect of criticism specificity on idea generation quality $F(1, 182) = 11.08$, $p \leq .01$. Specifically, higher quality ideas were generated when participants provided more specific, as opposed to more general criticisms (M = 2.57, SE = .05 vs. M = 2.24, SE = .08).

Self-criticisms operationality. Significant main effects were observed for criticism operationality on idea generation flexibility $F(1, 182) = 5.70$, $p \leq .05$, quality $F(1, 182) = 5.67$, $p \leq 05$, and originality $F(1, 182) = 4.41$, $p \leq .05$, as well as final plan quality $F(1, 182) = 7.58$, $p \leq .01$. That is, participants who produced more operant criticisms, as opposed to less operant criticisms, had more flexible (M = 2.85, SE = .08 vs. M = 2.55, SE = .10), higher quality (M = 2.54, SE = .06 vs. M = 2.32, SE = .07), more original ideas (M = 2.92, SE = .08 vs. M = 2.64, SE = .10), and higher quality final plans (M = 2.96, SE = .06 vs. M = 2.66, SE = .08).

Discussion

Limitations

Before discussing the implications of the present study, a few limitations should be noted. First, the present study used an undergraduate sample to examine the impact of the timing and attributes of self-criticisms on creative performance. Although most participants had previous experience or exposure to marketing and advertising, it is unclear whether similar findings would emerge in a more applied, real-world sample. It should also be noted that only one task in a specific domain (i.e., marketing) was used to examine the effects of self-criticism on creative performance. Thus, we cannot know for sure if these findings would generalize to other tasks in different domains. On a similar note, due to the low-fidelity, experimental nature of this study, the creative process unfolded over a relatively short period of time. However, real-world creative efforts likely unfold over much longer periods of time. Future studies should examine if these findings can be replicated in other populations and tasks, in various other domains and real-world creative efforts.

Another key limitation is that the criticism manipulation required participants to criticize their own work during only one stage of the creative process. Thus, the impact of providing criticisms in multiple stages was not examined. As a result, it is unclear what the findings would be if participants critiqued their work in multiple stages of the creative process. Future studies should examine the impact of critiquing one's own work during multiple creative process stages, as this is likely more reflective of real world creative efforts that involve multiple, often lengthy periods of reflection and revision. Future studies should also examine if it is more difficult to produce viable criticisms during certain stages of the creative process. Additionally, due to the experimental nature of the study, criticisms were induced, and did not occur organically. This poses another fidelity issue, and it is unclear if the criticisms that people decide to provide on

their own would produce the same outcomes. This, of course, is another area that should be explored in future research.

It is also important to note that the criticism manipulation prompted participants to provide 4 to 7 critiques. Thus, the interpretability of the findings was limited with respect to number of criticisms provided. Future efforts examining the impact of self-criticism should attempt to examine the impact of number of self-criticisms provided, in addition to attributes. Another limitation of this study was the limited number of criticism attributes examined. Although a good number of attributes (i.e., quality, depth, range, complexity, specificity, operationalism, and usefulness) were examined, there are clearly more self-criticism attributes that should be examined in future studies. For example, it could be that more creative criticisms lead to more creative problem solutions.

The nature of the complexity manipulation is also a limitation. Only one kind of task complexity (i.e., amount of information to work with) was manipulated. However, there are many other forms of task complexity that should be explored in future efforts. Another noteworthy direction for future research would be to examine the impact of time constraints on criticisms quality/viability. It could be that time constraints pose a limitation on critique effectiveness. Lastly, while some key individual difference variables (e.g., divergent thinking, planning skill, intelligence, expertise) known to influence creative performance were included in the study, we did not measure and include all possible individual difference variables that might influence creative performance.

General Discussion

Even bearing these limitations in mind, this study does have some noteworthy implications. Previous work on criticism and creativity suggests that people often critique their

own work during creative efforts (e.g., Kozbelt, 2017; Csikszentmihalyi, 1996). There is also substantial evidence that providing criticisms or evaluating ideas is an important component of creative thought (e.g., Lonergan et al., 2004; Runco & Vega, 1990). However, while some work has been conducted to better understand the nature and impact of interpersonal criticisms (i.e., criticizing others' work) and creative performance (e.g., Gibson & Mumford, 2013), very few efforts have sought to understand the role of intrapersonal criticisms (i.e., self-criticisms) in creative thought. Accordingly, one primary focus of the present effort was to examine what attributes of self-criticisms are the most useful for creative performance. This study found that providing criticisms that are high-quality overall, deep, complex, specific, operational, and useful/practical are positively related to a variety of creative performance criteria. It is also worth noting that the results obtained replicate the findings of Gibson & Mumford (2013) to some extent. Apparently, their general finding that the impact of criticisms on creative performance differ according to the attributes of the criticism extend to self-criticisms as well.

A second contribution of the present effort was to better understand the impact of self-criticisms throughout different stages of the creative process. Specifically, while it is clear people must critique/evaluate ideas once they are generated (e.g., Dailey & Mumford, 2006; Gibson & Mumford, 2013), less is known about the impact of self-critiques that occur during earlier to mid creative process stages (i.e., problem definition, information gathering, concept selection, conceptual combination), long before final ideas are generated. Because there is evidence that critiquing/revising one's own work is commonplace during creative efforts (e.g., Csikszentmihalyi, 1996; Graham & Harris, 1994; Kozbelt, 2017), the identification of self-criticisms attributes that are more or less useful at different stages of the creative process is important. For example, what types of critiques are the most impactful when critiquing one's

own work during the information gathering process? Unfortunately, this has received little attention in the literature. This study provides unique insights by contributing to our understanding of the role of self-criticisms throughout the creative process, and how to maximize their positive impact on creative performance. Specifically, this study demonstrates that the attributes of self-criticisms play a critical role in determining when, and under what conditions intrapersonal critiques ultimately impact creative performance the most.

One key takeaway of the present effort is the importance of providing quality self-critiques regardless of creative process stage. Apparently, the importance of providing quality self-criticisms during creative efforts is not stage specific. That is, if one decides to critique their own work at any stage of the creative process before generating ideas, providing high-quality self-critiques should always lead to better creative outcomes than low quality self-critiques. Broadly speaking, it could be that high quality self-criticisms encourage the development of stronger mental models via encouraging individuals to reflect on their performance and the assumptions that underly it. This reflection and challenging of assumptions may then lead individuals to develop more effective ways of understanding and interacting with a problem. Indeed, Mezirow (1991) proposed that reflecting on performance and challenging assumptions encourages transformative learning, a process that can shape and improve mental models. Better mental models, in turn, lead to better creative performance (Mumford et al., 2012).

Creative Stage and Criticism Attributes

While it does not appear to matter which stage of the creative process critiques are provided, it does seem important that critiques provided in certain process stages evidence certain attributes. Specifically, providing high-quality, complex self-criticisms that consider the complex interrelationships among issues during early-mid stages of the creative process (i.e.,

information gathering and concept selection) led to the highest levels of creative performance. For example, during the information gathering process, providing more complex critiques that accounted for interrelations among criticisms led participants to produce a larger number of ideas, more original ideas, and higher quality and more original plans. Additionally, higher quality, as opposed to lower quality self-critiques appeared especially important during concept selection for producing the most original plans.

Information gathering and criticism attributes. Information gathering involves reading through and encoding information relevant to the task, attending to inconsistent information, and discarding irrelevant information (Mumford et al., 1991). Thus, critiquing and reflecting on information while considering the complex interrelationships among issues in critiques could aid individuals in deciphering which information to attend to or discard. Additionally, providing such critiques to information gathered could help individuals structure the relationships among a wider range of information categories and develop more robust mental models of the problem—mental models that could provide a better foundation for executing later creative processes (e.g., concept selection, concept combination) and subsequent creative performance (Lubart, 2001; Mumford et al., 2012).

Concept selection and criticism attributes. The concept selection stage of the creative problem-solving process involves identifying relevant key concept categories from information gathered for solving the problem at hand (Mumford et al., 1996). These concept categories may include issues such as key constraints, goals, stakeholders, and standards to be applied. While providing quality criticisms across all stages of the creative process appears useful, providing quality criticisms during the concept selection stage appeared especially important— in concept selection, high quality criticisms led to the most original final plans. In contrast, the least original

final plans were produced when low quality criticisms were provided in the very same stage (i.e., concept selection). Taken together, these findings suggest that if critiques are provided during concept selection, it is important that they are high quality. Providing low quality criticisms during concept selection is worse than providing low quality criticisms during any other stage.

One potential explanation for this finding is that the concept selection stage of the creative process may be especially prone to error because it is a very cognitively demanding activity. Put differently, concept selection may be particularly vulnerable to limitations in human information processing capacity. Concept selection not only requires individuals to accurately process and make sense of numerous pieces of information, but also requires that they extract key concept categories from said information pertaining to the problem they defined. To cope with such demands, people may be more likely to inappropriately simplify certain processes and/or concepts during this stage, leading to error. Hence, individuals may greatly benefit from the performance reflection induced by quality self-critiques during concept selection. However, more research is needed to understand this in greater accuracy.

Task Complexity and Criticism Attributes

Another key finding of the present effort was that providing deeper criticisms, more complex criticisms, and more practical/useful criticisms appeared especially important when working on tasks that are complex. Providing deep self-critiques of one's own work may enhance creative performance on complex tasks because when criticisms are deep, individuals elaborate more thoroughly on important details, variables, or information that aids in making sense of complicated tasks. Similarly, when solving complex tasks, providing critiques that reflect commensurate levels of complexity could be helpful because accounting for the unique interrelationships and interactions among critiques may help participants successfully work

through complicated, multi-faceted information. Lastly, it could be that when making sense of complicated, complex information, focusing critiques on more practical issues that can be viably addressed (i.e., highly useful critiques) helps participants make sense and parse together the most pertinent aspects of complex information. Indeed, Barret et al. (2013) found that encouraging people to focus on the actual use of ideas led to both stronger mental models and better creative performance, providing some support for this notion. It would be fruitful to identify other creative task conditions that may benefit from providing self-critiques, such conditions with many constraints, or high levels of ambiguity.

Practical Implications

The findings of this study have clear implications for real-world creative efforts. Individuals undergoing creative efforts should feel free to engage in high-quality, constructive, task-related self-criticism at any time during creative efforts. However, if individuals want to critique their own work during the information gathering stage, special care should be taken to take complex relationships into account in their critiques to produce the most creative outcomes. Additionally, if critiques are provided during the concept selection stage, it is critical that they are high quality, otherwise the critiques may undermine creative performance. The complexity of the creative task must also be considered when determining what types of self-critiques to provide. Specifically, when working on highly complex problems, it may prove especially useful to provide critiques that are deep, practical, and commensurately complex to the task. In sum, individuals should not be discouraged from critiquing their own work throughout the creative process. However, it is not enough to simply critique one's own work—stage in the creative process and complexity of the task should be considered when forming self-criticisms.

Conclusion

In the present effort, an empirical examination of self-criticism attributes, self-criticism timing, and self-criticism context was conducted. Results suggest that while it does not matter which stage of the creative process self-criticisms are provided, it is always important that self-criticisms are of high quality. Additionally, our findings suggest that the impact of providing self-criticisms during certain creative process stages and under certain contexts depends on the characteristics of the criticism. Specifically, providing high-quality and complex self-criticisms during early-mid stages of the creative process (i.e., information gathering and concept selection) led to the highest levels of creative performance. Additionally, providing complex, practical, and deep criticisms under high levels of task complexity proved important. Of course, more research is needed to understand the mechanisms through which self-criticisms influence creativity. Nonetheless, we hope the findings in the present effort provide an impetus for future work examining the role that self-criticism plays in creativity.

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Table 1.

Means, Standard Deviations, and Correlations

		M	SD	1	2	3	4	5	6	7	8	9	10
1	Idea number	4.78	2.64	1									
2	Idea flexibility	2.72	.89	.65**	1								
3	Idea quality	2.44	.68	.67**	.75**	1							
4	Idea originality	2.82	.90	.59**	.76**	.77**	1						
5	Plan quality	2.84	.74	.33**	.46**	.48**	.49**	1					
6	Plan originality	2.78	.79	.30**	.40**	.37**	.52**	.77**	1				
7	Plan elegance	2.74	.66	.32**	.42**	.45**	.46**	.88**	.79**	1			
8	Criticism quality	2.67	.41	.22**	.34**	.45**	.41**	.41**	.39**	.45**	1		
9	Criticism depth	2.67	.56	.19**	.30**	.42**	.36**	.36**	.33**	.38**	.89**	1	
10	Criticism range	2.87	.47	.30**	.36**	.38**	.39**	.38**	.42**	.46**	.78**	.64**	1
11	Criticism complexity	2.61	.51	.14*	.21**	.32**	.25**	.25**	.20**	.29**	.81**	.78**	.52**
12	Criticism specificity	2.66	.46	.17*	.21**	.38**	.32**	.23**	.22**	.28**	.80**	.72**	.54**
13	Criticism operationalism	2.65	.51	.09	.27**	.27**	.30**	.35**	.30**	.34**	.72**	.51**	.48**
14	Criticism usefulness	2.54	.51	.20**	.34**	.43**	.40**	.42**	.41**	.44**	.86**	.67**	.66**
15	Task complexity	.51	.50	.05	.00	.10	.02	.08	.09	.05	-.04	-.06	-.02
16	Verbal intelligence	8.10	7.27	-.05	.03	.05	.07	.14*	.17*	.11	.25**	.25**	.14
17	Divergent thinking	33.33	11.04	.35**	.16*	.32**	.27**	.27**	.26**	.22**	.14*	.16*	.16*
18	Need for cognition	3.01	.64	-.09	.05	.07	.03	.12	.06	.04	.13	.14	.02
19	Planning skill	7.97	1.69	.04	.15*	.15*	.21**	.19**	.28**	.21**	.32**	.27**	.27**
20	Expertise	12.96	4.03	.06	.01	.04	.01	-.02	.04	.00	-.04	-.07	-.04
21	Neuroticism	3.66	.60	-.04	-.05	-.02	-.13	-.13	-.20**	-.13	-.21**	-.11	-.20**
22	Extraversion	3.99	.60	.01	-.02	.01	-.06	-.14*	-.16*	-.11	-.14*	-.13	-.13
23	Openness	3.14	.37	.10	.06	.03	.01	.02	-.01	.02	.06	.01	.06
24	Agreeableness	3.75	.39	-.04	.04	.01	-.06	-.11	-.14*	-.12	-.12	-.07	-.14
25	Conscientiousness	3.67	.39	.06	.01	-.05	-.04	-.07	-.03	-.03	-.01	-.05	.02
26	Age	18.55	.93	-.08	-.05	.09	-.01	.06	.01	.06	.03	.02	-.06

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level

Table 1 (continued).

Means, Standard Deviations, and Correlations

		M	SD	11	12	13	14	15	16	17	18	19
11	Criticism complexity	2.61	.51	1								
12	Criticism specificity	2.66	.46	.64**	1							
13	Criticism operationalism	2.65	.51	.44**	.42**	1						
14	Criticism usefulness	2.54	.51	.57**	.63**	.66**	1					
15	Task complexity	.51	.50	-.06	-.01	-.05	.03	1				
16	Verbal intelligence	8.10	7.27	.21**	.22**	.18**	.23**	.03	1			
17	Divergent thinking	33.33	11.04	.16*	.11	.03	.08	.02	.11	1		
18	Need for cognition	3.01	.64	.15*	.07	.15*	.11	.03	.06	-.09	1	
19	Planning skill	7.97	1.69	.22**	.27**	.22**	.29**	.02	.24**	.12	.13	1
20	Expertise	12.96	4.03	-.03	-.04	-.01	-.03	.10	.03	.01	.14*	-.07
21	Neuroticism	3.66	.60	-.06	-.22**	-.27**	-.19**	.01	-.07	-.01	-.01	-.27**
22	Extraversion	3.99	.60	-.02	-.10	-.19**	-.14*	-.02	-.10	-.10	-.03	-.34**
23	Openness	3.14	.37	.00	.02	.14*	.06	-.04	-.11	.01	-.07	.08
24	Agreeableness	3.75	.39	-.03	-.07	-.19**	-.11	.02	-.08	-.05	.16*	-.17*
25	Conscientiousness	3.67	.39	.00	.02	-.01	-.03	-.01	.11	-.03	-.11	-.14*
26	Age	18.55	.93	.02	.03	.07	.05	.07	-.01	-.01	.13	-.01

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level

Table 1 (continued).

Means, Standard Deviations, and Correlations

		M	SD	20	21	22	23	24	25	26
20	Expertise	12.96	4.03	1						
21	Neuroticism	3.66	.60	.07	1					
22	Extraversion	3.99	.60	.16*	.42**	1				
23	Openness	3.14	.37	-.12	-.11	-.05	1			
24	Agreeableness	3.75	.39	.06	.34**	.50**	.04	1		
25	Conscientiousness	3.67	.39	.16*	-.06	.42**	.06	.23**	1	
26	Age	18.55	.93	-.11	-.02	.05	-.14*	.00	-.01	1

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level

Table 2.

Regression Results for the Impact of Criticism Quality (Aggregate) on Idea Generation

		Number of Ideas			Idea Flexibility			Idea Quality			Idea Originality		
	Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Step 1	Divergent thinking	.35	.01	.000**	.15	.01	.033*	.32	.01	.000**	.25	.01	.000**
	Planning skill	-	-	-	.14	.04	.047	-	-	-	.18	.04	.009**
	R	.35	-	-	.22	-	-	.32	-	-	.32	-	-
	R2	.12	-	-	.05	-	-	.10	-	-	.11	-	-
Step 2	Divergent thinking	.33	.01	.000**	.12	.01	.083	.26	.01	.000**	.21	.01	.000**
	Planning skill	-	-	-	.04	.04	.553	-	-	-	.07	.04	.327
	Criticism quality (aggregate)	.16	.07	.014**	.32	.07	.000**	.42	.06	.000**	.37	.07	.000**
	R	.38	-	-	.37	-	-	.53	-	-	.47	-	-
	R2	.15	-	-	.14	-	-	.28	-	-	.23	-	-

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level.

Table 3.

Regression Results for the Impact of Criticism Quality (aggregate) on Final Plans

		Plan Quality			Plan Originality			Plan Elegance		
	Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Step 1	Divergent thinking	.25	.01	.000**	.24	.01	.000**	.20	.01	.003**
	Planning skill	.16	.04	.017**	.22	.04	.002**	.19	.04	.007**
	Neuroticism	-	-	-	-.14	.11	.043*	-	-	-
Step 2	R	.32	-	-	.39	-	-	.29	-	-
	R2	.10	-	-	.15	-	-	.09	-	-
	Divergent thinking	.21	.01	.001**	.20	.01	.002**	.16	.01	.012**
	Planning skill	.05	.04	.444	.14	.04	.049*	.06	.04	.366
	Neuroticism	-	-	-	-.10	.11	.141	-	-	-
	Criticism quality (aggregate)	.37	.07	.000**	.30	.07	.000**	.41	.07	.000**
	R	.47	-	-	.48	-	-	.48	-	-
	R2	.22	-	-	.23	-	-	.23	-	-

*Note. ** indicates significance at the .01 level, * indicates significance at the .05 level.*

Table 4.

ANCOVA Results for Criticism Stage, Task Complexity, and Criticism Quality (aggregate) on Idea Generation

	Number of Ideas				Idea Flexibility				Idea Quality				Idea Originality			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	p	η_p^2
Divergent thinking	1	23.43	.000**	.11	1	3.28	.072	.02	1	14.31	.000**	.07	1	7.45	.007**	.04
Planning skill	-	-	-	-	1	.97	.327	.01	-	-	-	-	1	2.59	.109	.01
Stage	3	.89	.448	.01	3	1.48	.223	.02	3	.28	.839	.01	3	.47	.705	.01
Complexity	1	.31	.578	.00	1	.08	.778	.00	1	1.43	.234	.01	1	.06	.816	.00
Quality	1	5.17	.024*	.03	1	12.67	.000**	.07	1	24.34	.000**	.12	1	20.62	.000**	.10
Stage*complexity	3	.82	.484	.01	3	.82	.483	.01	3	1.34	.263	.02	3	1.44	.233	.02
Stage* quality	3	.43	.729	.01	3	2.54	.058	.04	3	.22	.884	.00	3	.79	.502	.01
Complexity*quality	1	1.78	.184	.01	1	1.42	.236	.01	1	.97	.326	.01	1	.26	.611	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 5.

ANCOVA Results for Criticism Stage, Task Complexity, and Criticism Quality (aggregate) on Final Plans

	Final Plan Quality				Final Plan Originality				Final Plan Elegance			
	F	df	*p*	η_p^2	F	df	*p*	η_p^2	F	df	*p*	η_p^2
Divergent thinking	1	8.42	.004*	.04	1	7.67	.006**	.04	1	5.03	.026*	.03
Planning skill	1	2.52	.114	.01	1	6.95	.009**	.04	1	4.06	.045*	.02
Neuroticism	-	-	-	-	1	3.27	.072	.02	-	-	-	-
Stage	3	.56	.640	.01	3	1.40	.244	.02	3	.57	.638	.01
Complexity	1	2.61	.108	.01	1	3.75	.055	.02	1	1.25	.265	.01
Quality	1	16.63	.000**	.08	1	15.81	.001**	.08	1	17.11	.001**	.09
Stage*complexity	3	1.19	.315	.02	3	.83	.478	.01	3	.94	.421	.02
Stage*quality	3	.83	.480	.01	3	2.77	.043*	.04	3	1.07	.365	.02
Complexity*quality	1	1.94	.165	.01	1	1.21	.273	.01	1	1.99	.160	.01

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 6.

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Idea Generation

	Number of Ideas				Idea Flexibility				Idea Quality				Idea Originality			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	20.69	.000**	.10	1	2.77	.098	.02	1	13.20	.000**	.07	1	6.82	.010**	.04
Planning skill	-	-	-	-	1	1.20	.275	.01	-	-	-	-	1	2.29	.132	.01
Stage	3	.46	.714	.01	3	.41	.748	.01	3	.40	.754	.01	3	.05	.986	.00
Complexity	1	.37	.545	.00	1	.02	.884	.00	1	1.73	.190	.01	1	.03	.854	.00
Depth	1	1.98	.161	.01	1	4.39	.038*	.02	1	10.31	.002**	.05	1	11.66	.000**	.06
Stage*complexity	3	.90	.440	.02	3	.69	.562	.01	3	1.44	.233	.02	3	1.81	.146	.03
Stage*depth	3	1.95	.123	.03	3	1.31	.271	.02	3	.60	.615	.01	3	.92	.431	.02
Complexity* depth	1	.32	.570	.00	1	.04	.852	.00	1	.25	.618	.00	1	.10	.747	.00
Divergent thinking	1	26.87	.000**	.13	1	5.19	.024*	.03	1	18.41	.000**	.09	1	11.01	.001**	.06
Planning skill	-	-	-	-	1	2.34	.128	.01	-	-	-	-	1	4.87	.029**	.03
Stage	3	.10	.959	.00	3	.25	.864	.00	3	.62	.606	.01	3	.11	.952	.00
Complexity	1	.50	.482	.00	1	.46	.496	.00	1	.15	.702	.00	1	.03	.864	.00
Range	1	1.05	.307	.01	1	2.33	.129	.01	1	5.29	.023*	.03	1	3.26	.073	.02
Stage*complexity	3	.26	.858	.00	3	1.73	.162	.03	3	.28	.839	.01	3	.25	.865	.00
Stage* range	3	2.48	.063	.04	3	.79	.502	.01	3	.79	.503	.01	3	.64	.593	.01
Complexity* range	1	.00	.951	.00	1	.96	.328	.01	1	1.14	.288	.01	1	.32	.574	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 6 (continued).

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Idea Generation

	Number of Ideas				Idea Flexibility				Idea Quality				Idea Originality			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	24.78	.000**	.12	1	3.08	.081	.02	1	14.86	.000**	.08	1	8.14	.005**	.04
Planning skill	-	-	-	-	1	2.51	.115	.01	-	-	-	-	1	4.90	.028*	.03
Stage	3	.74	.528	.01	3	.69	.561	.01	3	.18	.908	.00	3	.43	.729	.01
Complexity	1	.13	.724	.00	1	.08	.779	.00	1	1.73	.190	.01	1	.00	.997	.00
Crit complexity	1	1.51	.221	.01	1	3.48	.064	.02	1	9.58	.002**	.05	1	7.30	.008**	.04
Stage*complexity	3	.85	.467	.01	3	.94	.423	.02	3	1.28	.283	.02	3	1.72	.164	.03
Stage*crit complexity	3	2.76	.043*	.04	3	2.58	.055	.04	3	1.04	.376	.02	3	2.60	.054*	.04
Complexity*crit complexity	1	.68	.411	.00	1	.43	.512	.00	1	.01	.907	.00	1	.00	.958	.00
Divergent thinking	1	25.48	.000**	.12	1	5.06	.026*	.03	1	19.21	.000**	.10	1	9.58	.002**	.05
Planning skill	-	-	-	-	1	3.21	.075	.02	-	-	-	-	1	5.13	.025*	.03
Stage	3	.64	.589	.01	3	.43	.734	.01	3	1.06	.367	.02	3	.08	.970	.00
Complexity	1	1.67	.198	.01	1	.01	.944	.00	1	3.65	.058	.02	1	.35	.553	.00
Specificity	1	.09	.759	.00	1	.20	.658	.00	1	11.08	.001**	.06	1	3.00	.085	.02
Stage*complexity	3	.57	.636	.01	3	.53	.660	.01	3	.32	.810	.01	3	.45	.717	.01
Stage*specificity	3	1.65	.180	.03	3	.60	.616	.01	3	1.70	.168	.03	3	.80	.495	.01
Complexity* specificity	1	.33	.566	.00	1	.02	.898	.00	1	.10	.748	.00	1	.29	.589	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 6 (continued).

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Idea Generation

	Number of Ideas				Idea Flexibility				Idea Quality				Idea Originality			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	32.82	.000**	.15	1	6.97	.009**	.04	1	22.60	.000**	.11	1	12.18	.000**	.06
Planning skill	-	-	-	-	1	1.36	.245	.01	-	-	-	-	1	3.89	.050*	.02
Stage	3	.85	.471	.14	3	.73	.536	.01	3	.24	.865	.00	3	.27	.849	.00
Complexity	1	.41	.524	.00	1	.05	.828	.00	1	1.15	.283	.00	1	.22	.641	.00
Operationality	1	1.09	.298	.01	1	5.70	.018*	.03	1	5.67	.018*	.03	1	4.41	.037*	.02
stage*complexity	3	.86	.461	.01	3	.77	.511	.01	3	1.15	.328	.02	3	.75	.525	.01
stage*operationality	3	1.61	.188	.03	3	1.45	.229	.02	3	.59	.618	.01	3	.16	.922	.00
Complexity* operationality	1	.75	.188	.00	1	1.18	.278	.01	1	.76	.385	.00	1	.01	.925	.00
Divergent thinking	1	27.78	.000**	.13	1	5.44	.021*	.03	1	21.71	.000**	.11	1	12.63	.000**	.07
Planning skill	-	-	-	-	1	1.33	.250	.01	-	-	-	-	1	2.31	.130	.01
Stage	3	.74	.528	.01	3	.71	.545	.01	3	.25	.860	.00	3	.15	.931	.00
Complexity	1	.61	.436	.00	1	.00	.962	.00	1	2.19	.141	.01	1	.14	.704	.00
Usefulness	1	7.79	.006**	.04	1	10.96	.001**	.06	1	31.40	.000**	.15	1	21.43	.000**	.11
Stage*complexity	3	.51	.672	.01	3	.46	.711	.01	3	.57	.637	.01	3	.72	.542	.01
Stage*usefulness	3	.13	.941	.00	3	1.14	.334	.02	3	.04	.990	.00	3	.43	.729	.01
Complexity* usefulness	1	.04	.851	.00	1	1.83	.178	.01	1	.27	.608	.00	1	.49	.483	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 7.

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Final Plans

	Final Plan Quality				Final Plan Originality				Final Plan Elegance			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	7.46	.007**	.04	1	7.00	.009**	.04	1	4.58	.034*	.02
Planning skill	1	2.83	.095	.02	1	6.39	.012*	.03	1	4.13	.044*	.02
Neuroticism	-	-	-	-	1	3.10	.080	.02	-	-	-	-
Stage	3	.57	.635	.01	3	1.83	.144	.03	3	.94	.420	.02
Complexity	1	1.23	.269	.01	1	1.31	.253	.01	1	.44	.509	.00
Depth	1	3.55	.061	.02	1	3.09	.080	.02	1	4.87	.029*	.03
Stage*complexity	3	.71	.550	.01	3	.43	.732	.01	3	.40	.752	.01
Stage* depth	3	.96	.412	.02	3	2.15	.095	.03	3	.77	.510	.01
Complexity* depth	1	.80	.373	.00	1	3.84	.052*	.02	1	2.34	.128	.01
Divergent thinking	1	8.52	.004**	.04	1	8.17	.005**	.04	1	5.10	.025*	.03
Planning skill	1	2.72	.101	.02	1	6.98	.009**	.04	1	3.40	.067	.02
Neuroticism	-	-	-	-	1	3.55	.061	.02	-	-	-	-
Stage	3	1.16	.327	.02	3	1.42	.238	.02	3	1.16	.326	.02
Complexity	1	.34	.559	.00	1	.95	.330	.01	1	.02	.892	.00
Range	1	10.44	.001**	.05	1	6.54	.011*	.04	1	13.30	.000**	.07
Stage*complexity	3	.09	.964	.00	3	.10	.958	.00	3	.42	.740	.01
Stage* range	3	.36	.783	.01	3	.28	.838	.01	3	.15	.930	.00
Complexity* range	1	.07	.797	.00	1	.05	.821	.00	1	.43	.512	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 7 (continued).

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Final Plans

	Final Plan Quality				Final Plan Originality				Final Plan Elegance			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	8.63	.004**	.05	1	8.17	.005**	.04	1	5.59	.019*	.03
Planning skill	1	3.21	.075	.02	1	6.96	.009**	.04	1	4.37	.038*	.02
Neuroticism	-	-	-	-	1	4.40	.037*	.02	-	-	-	-
Stage	3	.71	.550	.01	3	1.56	.201	.03	3	.84	.475	.01
Complexity	1	.79	.376	.00	1	.51	.474	.00	1	.13	.721	.00
Crit complexity	1	2.91	.090	.02	1	2.70	.102	.02	1	2.80	.096	.02
Stage*complexity	3	.85	.471	.01	3	.72	.540	.01	3	.47	.701	.01
Stage*crit complexity	3	4.15	.007**	.06	3	4.72	.003**	.07	3	2.25	.084	.04
Complexity*crit complexity	1	2.36	.126	.01	1	7.71	.006**	.04	1	3.68	.057	.02
Divergent thinking	1	9.81	.002**	.05	1	9.79	.002**	.05	1	5.86	.016*	.03
Planning skill	1	3.71	.056	.02	1	8.84	.003**	.05	1	5.15	.024*	.03
Neuroticism	-	-	-	-	1	4.59	.033*	.03	-	-	-	-
Stage	3	.42	.739	.01	3	1.55	.204	.03	3	.92	.433	.02
Complexity	1	1.30	.255	.01	1	2.24	.137	.01	1	.93	.336	.01
Specificity	1	1.23	.268	.01	1	.00	.954	.00	1	1.50	.222	.01
Stage*complexity	3	.55	.646	.01	3	.22	.883	.00	3	.24	.866	.00
Stage* specificity	3	.72	.539	.01	3	1.96	.121	.03	3	1.88	.134	.03
Complexity* specificity	1	.02	.887	.00	1	.32	.574	.00	1	.02	.885	.00

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Table 7 (continued).

ANCOVA Results for Criticism Stage, Task Complexity, and Specific Criticism Attributes on Final Plans

	Final Plan Quality				Final Plan Originality				Final Plan Elegance			
	df	F	*p*	η_p^2	df	F	*p*	η_p^2	df	F	*p*	η_p^2
Divergent thinking	1	12.08	.000**	.06	1	10.65	.001*	.06	1	7.30	.008*	.04
Planning skill	1	2.16	.143	.01	1	6.43	.012*	.03	1	4.30	.040*	.02
Neuroticism	-	-	-	-	1	3.76	.054*	.02	-	-	-	-
Stage	3	.68	.567	.01	3	1.56	.201	.03	3	.92	.434	.02
Complexity	1	1.47	.226	.01	1	2.26	.135	.01	1	1.07	.302	.01
Operationality	1	7.58	.006**	.04	1	1.47	.226	.01	1	3.63	.058	.02
stage*complexity	3	.39	.760	.01	3	.29	.835	.01	3	.41	.745	.01
stage* operationality	3	.23	.874	.00	3	.04	.989	.00	3	.31	.819	.01
Complexity* operationality	1	.61	.434	.00	1	.02	.882	.00	1	.00	.996	.00
Divergent thinking	1	13.40	.000**	.07	1	11.74	.000**	.06	1	7.98	.005**	.04
Planning skill	1	2.24	.137	.01	1	6.29	.013*	.03	1	3.58	.060	.02
Neuroticism	-	-	-	-	1	1.47	.227	.01	-	-	-	-
Stage	3	.34	.796	.01	3	1.04	.377	.02	3	.77	.515	.01
Complexity	1	1.69	.195	.01	1	2.45	.119	.01	1	.49	.485	.00
Usefulness	1	16.00	.000**	.08	1	16.01	.000**	.08	1	14.12	.000**	.07
Stage*complexity	3	1.11	.345	.02	3	.79	.503	.01	3	1.08	.360	.02
Stage*usefulness	3	.18	.913	.00	3	.35	.789	.01	3	1.34	.262	.02
Complexity* usefulness	1	6.31	.013*	.03	1	3.90	.050*	.02	1	2.41	.122	.01

Note. ** indicates significance at the .01 level, * indicates significance at the .05 level. df = degrees of freedom, F = F-ratio, *p* = significance level, η2 = effect size estimate. There were no significant three-way interactions.

Figure 1.
Example Behaviorally Anchored Rating Scale for Criticism Depth

Criticism Attribute Ratings

Depth

***Definition**:* the thoroughness or insightfulness of critiques

Things to look for:

- Critique is thorough, detailed, and comprehensive about issues covered
- Critiques elaborate on important details and information

1– Low Depth. The critique(s) are not detailed or thorough. They are not comprehensive at all and did not elaborate.

- Don't give up on your company
- The taste of root beer
- The bottle they use
- Be more competitive

2– Low to Average Depth.

3– Average Depth. Critiques are somewhat detailed but could be elaborated on more. The critiques could be more comprehensive about each theme but are still moderately comprehensive.

- Celebrities might not want to endorse it
- Some people might not like the drink and make a bad review
- Young workers might not work as hard as other workers
- People might not want to try a random sample of an unknown drink

4– Average to High Depth.

5– High Depth. Critiques are elaborative and detailed on each topic. Participant elaborates deeply on important details, variables, or information related to critique.

- Have not considered how television partnerships will be integrated into the show/what form advertisement will take place
- Might be too expensive to get recognizable figures to endorse big impact
- Consider demographics of younger people that would be the most interested in Big Impact—e.g., athletes, men
- Using social media can make it easier for people to be vocal about what they don't like about the company and might ruin the new image.

Figure 2.
Example Behaviorally Anchored Rating Scale for Idea Generation Flexibility

Idea Generation Ratings

Flexibility

Definition: The number of idea categories or themes (actual uniqueness of ideas).

Things to look for:

- **Number of Themes/themes:** Are there a variety of themes in the ideas generated? Are these themes unique to one another?

Rating Scale

1– Low Flexibility. The themes generated are similar to one another, or are highly related and not unique.

- Create social media
- Advertise using social media influencers

2– Low to Average Flexibility

3– Average Flexibility. Some of the themes generated are similar to one another. However, some are unique from the rest.

- Hire young people
- Hire women
- Add nutritional value to drinks
- Decrease sugar in drink
- New target demographic
- New logo
- Advertise on social media

4– Average to High Flexibility

5– High Flexibility. Most or all of the themes generated are in completely unique categories.

- More workers
- Different flavors
- Increase in price
- More locations
- Different textures

Figure 3.
Example Behaviorally Anchored Rating Scale for Final Plan Originality

Final Plan Ratings

Originality

Definition: The extent to which the plan is original, novel, or surprising.

Things to Look For

- **Unexpected:** Did the participant approach the problem in a novel, imaginative, unpredictable, or innovative manner?
- **Elaborative/Descriptive:** Did the participant provide a rich answer—one that helps the reader to visualize the solution for addressing the problem?

1 – Poor originality. The plan is very predictable and is given in basic terms with no elaboration. The plan only uses bare ideas and is commonplace and ordinary.

> We could offer a "diet" or "zero sugar" option of our root beer to interest those looking to live a healthier lifestyle. We could also produce a commercial or another ad form, featuring the ages we're looking to market to. Maybe even have them making a root beer float since that seems to be an issue as well.

2 – Poor to average originality. The plan presents ideas in a slightly unique manner. The plan mostly provides common ideas that do not reflect much elaboration or description.

3 – Average originality. The plan contains something that makes it different from the typical plan. The approach is original and contains some descriptive information. Description and elaboration are present but not entirely complete.

> To increase sales for Frosty Mug Root Beer you must target the consumers interest. Labeling your soda as "Grandpa's favorite soda" is not a good way to attract the younger generation. Placing more of your soda in popular restaurants would increase sales. You could also develop a new modern looking bottle for your soda to attract this younger generation. Carrying on the taste of your root beer is important but you could also develop different flavors to attract more people. If young adults want something more nutritious, look at your ingredients and see if there is a way to change the recipe and still keep the original flavor, making your soda a lot healthier. Hosting events or investing in some sort of food truck to serve delicious root beer floats at events to advertise your brand could also increase sales and consumers.

4 – Average to excellent originality. The plan contains something that makes it different from the typical solution. The approach is original and contains some descriptive information. Description and elaboration are present but not entirely complete.

5 – Excellent originality. The plan is exceptionally unique. The participant includes characteristics or details that make the plan unique to him/her. The plan clearly reflects an unexpected understanding approach to the problem and goes beyond the norm and presents new ideas that are highly descriptive.

> there are several things we can do to turn around or public image, especially with the younger generation. First we need to study what the younger generation is into and finds appealing. we start a new advertising campaign and incorporate things that the younger generation finds appealing to draw them to our product. Also we need to launch a new line of product that is eco friendly in the packaging, made out of bio degradable boxes and is made from all natural ingredients, this will show that we as a company care about the environment and our consumers health. this is huge in the younger generation and will draw them to us. Also, I think it would be a good idea to incorporate a willy Wonka golden ticket type of game with the population. I say as we mass produce our new product and our original product with a new look, we will put 3 different rare bottles or boxes. there will be very few and in crazy gold, silver, and bronze color ways. if one person can collect all three, they will receive a cash prize and a free two year supply of Frosty Mug Root Beer. We could also produce our own Root Beer Floats. we send them to stores in the ice cream section and have different flavors such as Carmel, hot fudge and so on. this will make kids want our product because it is already made and convenient. they will not have to go and buy ice cream, root beer and then combine it all and mix it. I believe that these are some ideas that could turn our company around if executed the right way.
> thank you