8-1-2016

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The Effect of Problem Construction Creativity on Solution Creativity Across Multiple Everyday Problems

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Research on creativity has indicated that problem construction, which is the process of making sense out of an ill-defined and ambiguous problem, has a positive influence on solution creativity. This relationship was more closely examined in a sample of university students using multiple everyday problems. Specifically, participants restated the problems in their own words and generated subsequent solutions. In addition, participants' fluency and problem construction ability were assessed. It was found that how participants constructed problems played an intervening role in the relationship between their overall problem construction ability and the creativity of the solutions they generated above and beyond fluency. This exact relationship, however, depended on the quality and originality of the problem constructions and solutions, as well as the problem. For 1 problem, a congruency effect was found such that problem construction quality predicted solution quality and problem construction originality predicted solution originality. For the other problem, only problem construction quality predicted both solution quality and originality. The results of this study provide evidence showing that problem construction is beneficial to solution creativity in everyday problems but that this relationship might be influenced by task.

Keywords:

creativity, creative cognition, problem construction, everyday problems, fluency

Creativity is defined as an idea or product that is both original and of high quality (Amabile, 1996; Mumford & Gustafson, 1988). *Originality* refers to the novelty or uniqueness of an idea or product, whereas *quality* refers its usefulness or appropriateness. Over the last several decades, creativity researchers have looked to the field of cognitive psychology to provide insights into the mental processes responsible for producing creative thought and subsequent creative outcomes. As a result of this endeavor, researchers have been able to gather unique insights into the creative process that had not been gained using traditional approaches to creativity such as personality, motivation, and environment (Finke, Ward, & Smith, 1992). Recent research emphasizing cognition has enhanced our understanding of the creative process, as well as the ability to facilitate and predict the production of creative outcomes (Mumford & Gustafson, 1988).

Creative cognition is the study of creativity from a cognitive perspective. Although several models of cognition exist in the field of cognitive psychology, only a few models emphasize the creative process (Finke et al., 1992; Mumford, Reiter-Palmon, & Redmond, 1994). Central to these models is the concept of *problem construction*, which refers to the act of structuring or defining an ill-defined or ambiguous problem. This concept is worth exploring more deeply as it has been consistently shown to have a positive influence on creativity (Getzels & Csikszentmihalyi, 1976; Okuda, Runco, & Berger, 1991).

Model of Problem Construction

Mumford, Mobley, Uhlman, Reiter-Palmon, and Doares (1991), suggested that problem construction is the first process in a series of eight core cognitive processes that drive creative cognition. The specific cognitive processes associated with problem construction are detailed in the model proposed by Mumford et al. (1994). According to the model, people attend to informational cues, which either signal to engage or not engage in problem construction. Informational cues that are personally meaningful and salient are believed to be most effective at signaling engagement in problem construction. Once engagement in problem construction begins, the informational cues activate *problem representations*, which are *mental features* that the perceiver associates with the informational cues or additional information pertaining to the problem (Holyoak, 1984). The problem representations may also contain procedures or key pieces of knowledge pertinent in defining and solving the problem. Associations between informational cues and problem representations are believed to be formed as a result of previous problem-solving experiences.

Complex problems yield more informational cues than simple problems, which result in an increased number of activated problem representations (Mumford et al., 1994). At this point in the process, people will engage in a screening strategy by creating a decision rule for consciously and efficiently sorting through the activated problem representations. The screening strategy is also necessary in reducing the number of problem representations so that people are able to construct a more narrowly defined and focused problem. Finally, the problem representations are translated into more tangible elements (e.g., verbal statements) that form the constructed problem.

Reiter-Palmon, Mumford, O'Connor-Boes, and Runco (1997) provided support for the model by demonstrating how the activation of problem representations influenced problem construction. In their study, each participant was presented with a scenario depicting a problem (e.g., social dilemma). For half of the participants, information presented in the scenario was consistent, whereas for the other half it was inconsistent. Active processing was also induced in half of the participants, but not induced for the other. Finally, participants' problem construction ability, or the propensity and skill to engage in problem construction, was measured. It was discovered that students who demonstrated superior problem construction ability benefitted by the active-processing manipulation in that it increased engagement in problem construction. In addition, the inconsistent information presented in the problems likely activated a diverse set of mental representations, which subsequently led to more original solutions. Finally, having ability or skill in problem construction helped in making sense of, combining, and applying the activated mental representations appropriately to create high-quality solutions.

Problem Construction and Creativity

The relationship between problem construction and creativity is intricate, and researchers have sought to better understand its complexities. For instance, Mumford, Baughman, Threlfall, Supinski, and Costanza (1996) showed that when presenting participants with a diverse set of problem restatements, those who chose restatements that were considered high in quality and originality tended to also generate more creative solutions. Further, selecting high quality and original problem restatements was unrelated to participants' scores on multiple indices of intelligence, which indicated that problem construction uniquely contributed to creativity in a way that was not accounted for by intelligence.

The relationship between problem construction and creativity has also been shown to be influenced by contextual factors, such as instructions (Hunter, Bedell, & Mumford, 2007). For instance, simply instructing participants to actively engage in problem construction has been shown to be effective in inducing engagement in the problem construction process, which subsequently had a positive influence on creativity (Bernardo, 2001). In addition, Redmond, Mumford, and Teach (1993) asked college students to assume the role of marketing intern and assigned them to different leaders. The researchers found that students whose leaders provided encouragement and direction on how to engage in problem construction tended to generate the most creative solutions compared with students whose leaders did not.

In addition to instructions, creativity training programs have also been shown to influence the relationship between problem construction and creativity (Basadur, Graen, & Green, 1982; Fontenot, 1993; Hunter et al., 2007). Baer (1988) examined the effectiveness of creativity training programs on problem construction in a sample of eighth-grade students. The creativity training consisted of five-steps: data-finding, problem-finding, idea-finding, solution-finding, and action planning. To assess the effectiveness of training, participants completed measures of problem construction ability before, immediately after, and 6 months after the training occurred. Overall, participants who received training exhibited greater ability to construct problems creatively immediately after the training was completed. Further, participants who received the creativity training also generated solutions that were rated as more creative on a problem-solving task immediately and 6-months after the creativity training was completed.

The studies that have been referenced so far examined the effect of problem construction on creative outcomes by way of either ability or instruction. Although the findings from these studies have provided evidence showing that problem construction is, overall, beneficial to creativity, these studies did not directly examine the relationship between how a specific problem is constructed and the resulting creativity of the solution.

Only one study has examined how problem construction directly related to the creativity of the resulting solutions, as well as the specific aspects of problem construction related to creativity. Getzels and Csikzentmihalyi (1976) examined this relationship in a sample of graduate students who were pursuing their degree in fine arts. The researchers asked the students, one at a time, to create a sketch of objects. A number of objects were presented to the students who were allowed to pick and choose from the available objects and arrange them in whichever way they determined was appropriate for the sketch. The researchers observed this process from start to finish. Problem construction was assessed by counting the number of objects each student handled and the amount of time spent handling the objects. In addition, the researchers took into account the popularity of each object handled by the students. Because some objects were handled more frequently by the students than others, it was believed that handling less popular items represented a more novel problem construction. Finally, the researchers asked students to reflect on the artistic problem they attempted to construct and to specify at what point in the sketch did they “settle” on a final problem construction (i.e., some settled before beginning their sketch, while others did not settle until partway through).

Getzels and Csikszentmihalyi (1976) quantified and weighted each of the metrics, and computed a final problem construction score. This score was then correlated with evaluations of the sketch’s creativity, which included dimensions such as aesthetic quality and originality. It was reported that the overall problem construction score was related to originality, but not aesthetic quality. However, time spent during problem construction, by itself, was related to aesthetic quality.

Purpose of Study

Getzels and Csikzentmihalyi’s (1976) study demonstrated that how a specific problem is constructed relates directly to the creativity of the solutions, and that different aspects of problem construction are differentially related to aspects of the solution. However, their study examined this relationship in the domain of art, specifically painting, which may not generalize to other domains. As a result, there is a need to better explore how processes such as problem construction influence creativity in a different domain.

Therefore, the purpose of this study was twofold. First, to examine the relationship between problem construction and the creativity of the solution in a different domain, everyday problem solving. The second purpose was to examine whether problem construction quality and originality, as specific aspects of problem construction, mediate the relationship between problem construction ability and the quality and originality of solutions. Further, because past work has demonstrated that different tasks may elicit different effects also based on the specific aspect of creativity evaluated such as fluency, originality, or quality (Reiter-Palmon, Illies, Cross, Buboltz, & Nimps, 2009; Runco, Illies, & Eisenman's, 2005) we examined these relationships across multiple problems (tasks).

Hypotheses

These hypotheses were tested separately for each problem as opposed to aggregating results across all problems.

Hypothesis 1: Problem construction ability will be positively related to the quality and originality of problem constructions and solutions across multiple problems.

Hypothesis 2: Problem construction quality and originality will mediate the relationship between problem construction ability and the quality of solutions to everyday problems.

Hypothesis 3: Problem construction quality and originality will mediate the relationship between problem construction ability and the originality of solutions to everyday problems.

Method

Participants

A sample of 167 undergraduate participants (113 women, 52 men, and two undisclosed) were recruited from a midwestern university using SONA, a Web-based recruitment tool. Over half the participants (60%) were between the ages of 18 and 20 years, whereas the rest of the participants were between the ages of 21 and 44 years ($M = 24$, $SD = 4.06$). Participants received course credit for their participation. All participants provided consent before beginning the study.

Procedure

The study was accessed via the Internet using a hyperlink provided to participants upon registration on SONA. First, problem construction ability was assessed using an approach adopted by Baer (1988) in which participants were presented two relatively brief problem statements and instructed to list as many restatements of the problem as they could. An example problem statement includes "you are the principal of an elementary school. One of your students brought a pet snake to school today, and just discovered that it is missing from its cage." Next, participants were given two everyday problems with which college students were likely to be familiar. In this case, the distinction between problem construction ability and problem construction is that the former provides a general estimate of problem construction, whereas the latter is an assessment of the problem construction process that pertains to the problem being solved.

Participants were instructed to imagine themselves in the everyday problem scenarios. The problems were counterbalanced to control for order effects. Everyday Problem 1 depicted a college student who is captain of the swim team, and faced with a dilemma in which the responsibilities of swim captain conflict with relationships to subordinates and friends. Everyday Problem 2 depicted a college student who is faced with multiple, attractive options of what to do after finishing college. After reading each everyday problem scenario, all participants were instructed to restate the problem in their own words in as many different ways as they could. This manipulation has been used in the past to actively engage participants in problem construction (ReiterPalmon et al., 1997), and allowed us to directly evaluate the quality and originality of problem construction. Participants were instructed to provide a solution to their restated problem. Finally, participants completed a divergent thinking task that was scored for fluency. Fluency was used as a covariate in this study.

Tasks and Ratings

Three different raters were used for each rating. The raters used in this study were a mixture of undergraduate and graduate students in psychology. All raters received appropriate training in advance. Training focused on the concept of creativity, creativity in everyday problem solving, the rating scales used, and discussion of the specific problem evaluated. Interrater agreement across all raters was assessed using within-group variance (r_{wg}; James, Demaree, & Wolf, 1984) and intraclass correlations (ICCs; Shrout & Fleiss, 1979). A rating of .70 and above for r_{wg} (James et al., 1984) and a rating of .60 or above for ICCs (Shrout & Fleiss, 1979) are considered acceptable ratings of reliability for research purposes.

Quality and originality of problem constructions. The quality and originality of the problem constructions generated during the problem construction ability task and the everyday problem scenarios were evaluated using a modified version of Amabile's (1996) consensual assessment technique. Three trained raters rated each participant's problem constructions. Although participants were asked to generate multiple problem restatements, for the purpose of this study, the problem restatements were rated as a whole, as opposed to each problem restatement independently.

Quality was defined as the degree to which the problem constructions were feasible or possible, as well as the extent to which the problem constructions, as a whole, completely represented the context. Quality also included the level in which detail was provided and the degree to which the problem constructions covered multiple different views of the problem. For quality, a 1 = *very low quality* and a 5 = *very high quality* scale was used. Originality was defined as the degree to which the problem constructions as a whole diverged from the problem situation presented and went beyond it, yet did not alter the focus or scope of the problem. Further, the degree to which the problem constructions were not obvious from the situation, as well as the novelty and uniqueness of the problem constructions were taken into account. For originality, a 1 very low originality and a 5 very high originality scale was used.

Table 1
Rater Reliabilities for Quality and Originality of Problem Constructions and Solutions

Rating	r_{wg}	ICC
Problem construction ability ratings		
Item 1: Quality	.83	.90
Item 1: Originality	.74	.83
Item 2: Quality	.74	.89
Item 2: Originality	.80	.87
Problem 1 ratings		
Problem construction quality	.83	.90
Problem construction originality	.74	.75
Solution quality	.84	.87
Solution originality	.82	.85
Problem 2 ratings		
Problem construction quality	.81	.88
Problem construction originality	.65	.67
Solution quality	.82	.87
Solution originality	.78	.83

Note. ICC = intraclass correlations.

Table 1 provides the reliabilities associated with these ratings. For the most part, the interrater reliabilities were above the cutoff scores (James et al., 1984; Shrout & Fleiss, 1979). However, it should be noted that for Problem 2, the r_{wg} for problem construction originality (r_{wg} = .65), is somewhat low given that it falls below the .70 standard (James et al., 1984). For the problem construction ability ratings, the quality ratings were averaged across both items, as well as the originality ratings. The resulting quality and originality ratings were multiplied to create a single composite score. High scores indicated high problem construction ability. For the everyday problem scenarios, the quality and originality ratings were averaged across the three raters to create a single score for each measure (i.e., a quality rating for each problem and an originality rating for each problem resulting in a total of four scores). It is important to note that the measure of problem construction ability and the measure of every day problem solving were distinct in terms of the problems used to assess the constructs and the manner in which the ratings were treated.

Quality and originality of solutions to everyday problems. The quality and originality of solutions for both of the everyday problem scenarios were also assessed using a modified version of Amabile's (1996) consensual assessment technique. Three trained raters rated each solution as a whole for quality and originality. Quality was defined as the degree to which the solution was plausible, appropriate, and a viable solution to the problem. For quality, a 1 = *very low quality* and a 5 = *very high quality* scale was used. Originality was defined as the degree to which the solution was unique and unrelated to the problem. For originality, a 1 = *very low originality* and a 5 = *very high originality* scale was used. The quality and originality ratings were averaged across the three raters to create a single score for each measure (i.e., a quality rating for each problem and an originality rating for each problem resulting in a total of four scores). Table 1 also contains the reliabilities associated with the solution ratings for quality and originality. The reliabilities were acceptable for each of the ratings (James et al., 1984; Shrout & Fleiss, 1979).

Fluency as a Control Variable

To more closely examine the relationship between the quality and originality of the problem construction process and the quality and originality of solutions it was important to tease out contaminating factors that have been shown to influence creative outcomes. As a result, fluency, which is the generation of multiple, diverse ideas for a particular idea or object, was controlled for as it has been shown to be correlated with the originality of ideas (Runco, 1991). We assessed fluency using a divergent thinking task in which participants provided uses for a brick. The number of ideas generated was counted, with high counts indicating a high degree of fluency.

Results

Descriptive statistics and correlations are presented in Table 2 and Table 3. Before running the primary analyses, we wanted to ensure that the order of presentation of the everyday problems did not influence solution quality and originality and, therefore, tested for order effects using *t* tests. The *t* tests revealed that the order in which participants received the two problems did not affect the quality and originality of the solutions generated, and therefore, we were able to test our hypotheses without needing to control for order effects. The hypotheses were tested using a hierarchical regression approach appropriate for assessing and comparing regression models containing multiple mediators (Preacher & Hayes, 2008).

The variables were entered via a SPSS macro designed for testing these models.[1] Fluency was entered as a control variable, problem construction ability was entered as an IV, and problem construction quality and originality of the everyday problem solving scenarios were simultaneously entered as mediators separately for each everyday problem. Similarly, the two dependent variables, solution quality and

1 This macro can be accessed at http://www.afhayes.com/spss-sas-andmplus-macros-and-code.html

solution originality, were separately regressed onto these variables for Problems 1 and 2. That is, a separate analysis was conducted for each everyday problem-dependent variable combination resulting in a total of four primary analyses. For these analyses, the indirect effect was evaluated using a bootstrap resampling technique. The maximum number of samples to estimate was set 5,000. Finally, we used a 95% bias corrected confidence interval (CI) to determine the significance of each mediator. No statistical assumptions of regression were violated.

Everyday Problem 1

For Problem 1, problem construction ability was positively related to problem construction quality (r = .26, p < .01) and originality (r = .33, p < .01) and solution quality (r = .37, p < .01) and originality (r = .34, p < .01), lending support for Hypothesis 1. In testing Hypothesis 2, we found that the relationship between problem construction ability and solution quality was partially mediated by problem construction quality when controlling for fluency (Tables 4 and 5). The standardized regression coefficient between problem construction ability and problem construction quality was significant (β = .24, p < .01), as was problem construction quality and solution quality (β = .39, p < .01). The standardized indirect effect was .10. We tested the significance of the indirect effect using bootstrapping procedures. Unstandardized indirect effects were computed for each of 5,000 bootstrapped samples, and the 95% CI was computed by determining the indirect effects at the 2.5th and 97.5th percentiles. The bootstrapped unstandardized indirect effect was .02, and the 95% CI ranged from .00 to .03. Thus, the indirect effect was statistically significant.

Table 2
Descriptive Statistics and Correlations Between Fluency, Problem Construction Ratings, and Solution Ratings for Problem 1

Rating	*M*	*SD*	Min	Max	Statistic	2	3	4	5	6
1. Fluency	12.92	7.75	1.5	41	*r*	.44**	.21*	.07	.29**	.25**
					N	150	152	149	153	152
2. PC ability	10.99	5.16	1	25	*r*		.26**	.33**	.37**	.34**
					N		163	160	164	163
3. PC quality	2.96	1.01	1	5	*r*			.56**	.52**	.26**
					N			163	166	165
4. PC originality	2.99	1.01	1	5	*r*				.35**	.35**
					N				163	162
5. Solution quality	2.90	.83	1	4.67	*r*					.44**
					N					166
6. Solution originality	2.80	.81	1	5	*r*					
					N					

Note. PC = problem construction.
* $p < .05$. ** $p < .01$.

For Hypothesis 3, it was found that problem construction originality partially mediated the relationship between problem construction ability and solution originality controlling for fluency (Tables 5 and 6). The standardized regression coefficient between problem construction ability and problem construction originality was significant (β = .37, p<.01), as was problem construction originality and solution quality (β = .27, p<.01). The standardized indirect effect was .10. The bootstrapped unstandardized indirect effect was .02, and the 95% CI ranged from .01 to .04. Thus, the indirect effect was statistically significant. It is interesting that these findings demonstrated the importance of congruency when generating high quality and original solutions. That is, when generating original solutions, original interpretations of the problem are important, whereas when generating quality solutions, quality interpretations of the problem are important above and beyond problem construction ability.

Everyday Problem 2

For Problem 2, problem construction ability was positively related to problem construction quality, $r = .37$, $p<.01$ and originality, $r = .40$, $p < .01$ and solution quality, $r = .38$, $p < .01$ and originality, $r = .32$, $p < .01$ lending support for Hypothesis 1.We applied the same statistical approach used to examine Problem 1, to test hypotheses for Problem 2 (Tables 5 and 7). In testing Hypothesis 2, for Problem 2, the relationship between problem construction ability and solution quality was partially mediated by problem construction quality controlling for fluency. The standardized regression coefficient between problem construction ability and problem construction quality was significant (β = .28, $p < .01$), as was problem construction quality and solution quality (β = .33, $p < .01$). The standardized indirect effect was .10. The bootstrapped unstandardized indirect effect was .02, and the 95% CI ranged from .00 to .03. Thus, the indirect effect was statistically significant.

Table 3

Descriptive Statistics and Correlations Between Fluency, Problem Construction Ratings, and Solution Ratings for Problem 2

Rating	*M*	*SD*	Min	Max	Statistic	2	3	4	5	6
1. Fluency	12.92	7.75	1.5	41	*r*	.44**	.17*	.07	.36**	.31**
	1.				*N*	150	153	150	150	150
2. PC ability	10.99	5.16	1	25	*r*		.27**	.40**	.38**	.32**
	1.				*N*		164	161	161	161
3. PC quality	2.99	.94	1	5	*r*			.44**	.46**	.38*
	1.				*N*			164	164	164
4. PC originality	2.86	.89	1	5	*r*				.33**	.30**
	1.				*N*				161	161
5. Solution quality	2.79	.93	1	5	*r*					.67**
	1.				*N*					162
6. Solution originality	2.77	.93	1	5	*r*					
					N					

Note. PC = problem construction.
$^{*}p < .05$. $^{**}p < .01$.

Table 4

Problem Construction Quality Partially Mediating the Relationship Between Problem Construction Ability and Solution Quality Controlling for Fluency for Problem 1

Model	*b*	*SE*	β	*R*	R^2	ΔR^2	95% CI
Model 1				.29	.08**	.08**	
Intercept	2.51**	.12					[2.26, 2.75]
Fluency	.03**	.01	.29**				[.01, .05]
Model 2				.40	.15**	.07**	
Intercept	2.17**	.15					[1.87, 2.47]
Fluency	.02	.01	.16				[−.00, .03]
PC ability	.05**	.01	.30**				[.02, .07]
Model 3				.58	.32**	.18**	
Intercept	1.30**	.23					[.85, 1.74]
Fluency	.01	.01	.11**				[−.00, .03]
PC ability	.03**	.01	.20**				[.01, .06]
PC quality	.34**	.07	.43**				[.21, .47]
PC originality	.03	.08	.03				[−.13, .20]

Note. $n = 167$. PC = problem construction; CI = confidence interval.
$^{**}p < .01$.

Table 5

Indirect Effects of Problem Construction Ability on Solution Quality and Originality Through Problem Construction Quality and Originality

Mediator	Dependent variable	*b*	*SE*	β	95% CI
	Problem 1				
PC quality	Solution quality	.02*	.01	.10*	[.00, .03]
PC originality	Solution quality	.00	.01	.02	[−.01, .02]
PC quality	Solution originality	.00	.00	.02	[−.00, .01]
PC originality	Solution originality	.02*	.01	.10*	[.01, .04]
	Problem 2				
PC quality	Solution quality	.02*	.01	.10*	[.01, .03]
PC originality	Solution quality	.01	.01	.03	[−.01, .02]
PC quality	Solution originality	.01*	.01	.07*	[.00, .02]
PC originality	Solution originality	.01	.01	.04	[−.00, .02]

Note. $n = 167$. Indirect effects were computed for each of 5,000 bootstrapped samples. PC = problem construction; CI = confidence interval.
$^{*}p < .05$.

For Hypothesis 3, it was found that problem construction quality partially mediated the relationship between problem construction ability and solution originality controlling for fluency (Tables 5 and 8). The standardized regression coefficient between problem construction ability and problem construction quality was significant (β = .28, *p*< .01), as was problem construction quality and solution originality (β = .26, *p* < .01). The standardized indirect effect was .07. The bootstrapped unstandardized indirect effect was .01, and the 95% CI ranged from .00 and .02. Thus, the indirect effect was statistically significant. In summary, for Problem 2, while problem construction ability was useful in generating high quality and original solutions, constructing problems in a high quality fashion was uniquely useful in generating high quality and original solutions.

Table 6
Problem Construction Originality Partially Mediating the Relationship Between Problem Construction Ability and Solution Originality Controlling for Fluency for Problem 1

Model	*b*	*SE*	β	*R*	R^2	ΔR^2	95% CI
Model 1				.25	.06**	.06**	
Intercept	2.41						[2.13, 2.69]
Fluency	.03**		.25**				[.01, .05]
Model 2				.36	.13**	.12**	
Intercept	2.04**	.18					[1.69, 2.40]
Fluency	.02	.01	.13				[−.01, .04]
PC ability	.05*	.02	.28*				[.02, .08]
Model 3				.44	.20**	.07**	
Intercept	1.26**	.28					[.70, 1.82]
Fluency	.02	.01	.15				[−.00, .04]
PC ability	.03*	.02	.18*				[.00, .06]
PC quality	.04	.08	.04				[−.13, .20]
PC originality	.28**	.11	.25**				[.08, .49]

Note. $n = 167$. PC = problem construction; CI = confidence interval.
$^{*}p < .05$. $^{**}p < .01$.

Table 7
Problem Construction Quality Partially Mediating the Relationship Between Problem Construction Ability and Solution Quality Controlling for Fluency for Problem 2

Model	*b*	*SE*	β	*R*	R^2	ΔR^2	95% CI
Model 1				.36	.13**	.13**	
Intercept	2.23**	.14					[1.96, 2.51]
Fluency	.04**	.01	.36**				[.03, .06]
Model 2				.44	.19**	.06**	
Intercept	1.87**	.17					[1.53, 2.21]
Fluency	.03**	.01	.24**				[.01, .05]
PC ability	.05**	.02	.28**				[.02, .08]
Model 3				.57	.33**	.14**	
Intercept	.87**	.26					[.37, 1.38]
Fluency	.03**	.01	.22**				[.01, .05]
PC ability	.03*	.02	.16*				[.00, .06]
PC quality	.34**	.08	.35**				[.20, .49]
PC originality	.08	.08	.08				[−.08, .25]

Note. $n = 167$. PC = problem construction; CI = confidence interval.
$^{*}p < .05$. $^{**}p < .01$.

Table 8
Problem Construction Quality Partially Mediating the Relationship Between Problem Construction Ability and Solution Originality Controlling for Fluency for Problem 2

Model	*b*	*SE*	β	*R*	R^2	ΔR^2	95% CI
Model 1				.31	.10**	.10**	
Intercept	2.29**	.14					[2.02, 2.57]
Fluency	.04**	.01	.31**				[.02, .06]
Model 2				.37	.14**	.04**	
Intercept	2.00**	.18					[1.65, 2.35]
Fluency	.03**	.01	.21**				[.01, .05]
PC ability	.04*	.02	.23*				[.01, .07]
Model 3				.48	.23**	.09**	
Intercept	1.14**	.27					[.60, 1.68]
Fluency	.02*	.01	.20*				[.01, .04]
PC ability	.02	.02	.12				[−.01, .05]
PC quality	.26**	.08	.26**				[.10, .42]
PC originality	.11	.09	.11				[−.07, .29]

Note. $n = 167$. PC = problem construction; CI = confidence interval.
$^{*}p < .05$. $^{**}p < .01$.

Overall, a different pattern of relationships emerged across the two problems. Specifically, a congruency effect was observed for Problem 1 such that problem construction quality predicted solution quality and problem construction originality predicted solution originality. For Problem 2, problem construction quality predicted both solution quality and originality. Problem construction originality did not emerge as a significant predictor for Problem 2.

Discussion

Overall, the findings from this study indicated that for everyday problems, problem construction quality and originality partially mediate the relationship between problem construction ability and solution quality and originality after controlling for fluency. However, the pattern of effects varied by problem; thus, suggesting that task may play a role in this relationship.

Theoretical Implications

Consistent with past research (Getzels & Csikszentmihalyi, 1976; Lyles & Mitroff, 1980; Okuda et al., 1991), this study found that problem construction is beneficial to creativity. Further, these findings provide a unique contribution to the literature in that this study is the first to examine the direct influence of the quality and originality of the problem construction on the quality and originality of subsequent solutions generated to everyday problems. Although theory and research have demonstrated that problem construction is beneficial to creativity, only one previous study has evaluated this direct relationship, and no other study has made this specific link using everyday problems.

This study adds to the literature on task effects in creative cognition. This study used problem constructions and solutions generated from two everyday problem solving tasks. It was found that problem construction quality and originality accounted for a significant amount of variance in the quality and originality of the solutions; however, in examining the results of the mediation analysis, it was revealed that the exact nature of this relationship varied by problem. This finding suggests that task could play a key role in the relationship between the problem construction process and solution creativity.

The issue of task effects on creative cognition is controversial. One side of the controversy posits that creativity is domain specific meaning that knowledge of a specific domain is required to produce creative outcomes. The other side of the controversy posits that creativity is domain general meaning creative individuals are capable of being creative in a diverse set of domains (Baer, 1993; Baer & Kaufman, 2005; Reiter-Palmon et al., 2009). An interesting finding from this study, is that we observed variation in the relationship between quality and originality (i.e., indicators of creativity) within the same domain— everyday (i.e., everyday) problem solving.

This observation could simply reflect the broad nature of this domain. That is, broad domains are open, and therefore, provide “space” or “room” for these relationships to vary because of minimal constraints. However, this observation could also suggest the existence of another layer of complexity surrounding the study of creative problem solving beyond issues of domain generality versus specificity. For instance, it could be the case that some domains, especially broad domains, are multidimensional. If the latter is true, then we may need to consider whether or not the cognitive operations that influence creativity in one dimension, also influence creativity on another dimension.

Researchers should also consider other factors that could potentially play a role in creative cognition. The concept of *construal*, which refers to how people perceive and interpret the world around them (Schlesinger, 1980), has been discussed in models of creative cognition (e.g., Mumford et al., 1994), but unfortunately has received little empirical attention. For instance, construal may be particularly important to problem construction. Because there can be a large degree of variability within a given problem space (Reed & Abramson, 1976), researchers should examine how variation in problems, such as psychological meaningfulness, influences creative cognition. Using the problems from this study as an example, it was noticed, after the fact, that themes within each of the problems varied in what could be psychologically meaningful ways. For Problem 1, the swim team is away at an out of town meet, and was given orders by the coach to not leave their place of stay. An aspect of this problem is the coach who represents an element of *authority*. Problem 2 also has an element of authority, which is represented by the subject's parent and academic advisor.

In addition to the element of authority, Problems 1 and 2 also contain two other elements: leadership and consequence. For Problem 1, the participants were asked to imagine themselves in a leadership position (i.e., swim team captain), whereas for Problem 2, the participants were not asked to imagine themselves in a leadership position. For Problem 1, the possible consequences of the problem were arguably more short term compared with Problem 2, where the consequences were more long term. Specifically, the consequences for not doing well at a college swim meet would likely have less of a long-term impact on someone compared with choosing a college major and career path for most people. Given these potential consequences and whether or not one takes the role of leader could have likely influenced the way participants perceived and interpreted the problems, which in turn could have influenced their solutions.

Limitations

One limitation of this study was the use of problems that did not fully capture the kinds of problems that college students are likely to encounter. This study used two problems, one that pertained to athletics and leadership and another that pertained to academic planning and authority (i.e., parent vs. academic advisor). There are, of course, other kinds of problems that college students face that were not included in this study; for instance, problems related to courses, sororities and fraternities, and the cost of college, to name a few. By not including additional problems in this study, we are limited in the generalizations that can be made regarding how problem construction creativity influences solution creativity across various forms of everyday problems.

In addition, the extent to which participants were engaged in the problem-solving process is unknown. Outside of a laboratory environment, people are probably more engaged in the problems they encounter because they have a stake in the outcome. In contrast, the participants in this study were probably less engaged in the problem-solving process because the situation was hypothetical, and therefore, they would not have to face any consequences resulting from the solutions they provided. Engagement in this case may be important because it could influence the effort that people put into problem solving.

Some participants also may not have been able to adequately imagine themselves in the hypothetical problems they were asked to solve. By not being able to take this perspective, participants may have been limited in their capabilities to fully ascertain the problem and provide an appropriate solution. Moreover, participants may have been more capable of relating to one problem over the other as a result of past experiences. For instance, even though college students engage in academic planning at some point, a topic included in one of the problems, the extent to which they could relate to the academic-planning scenario portrayed in this study likely varied. Unfortunately, data regarding whether this issue was the case is unavailable.

Although problem construction creativity was operationalized in a manner that is supported in the literature (Getzels & Csikzentmihalyi, 1976), there is always the possibility that this approach does not fully capture how problem construction occurs outside of a lab setting. That is, there is a degree of artificiality present in this methodology because of the fact that participants must transcribe their thoughts, problem construction may occur so fast that individuals are not conscious of it, or they may not be able to always articulate it. Further, because we asked participants to respond in writing (typing), this process may be affected by typing speed and ability to accurately describe the problem construction process.

Finally, a possible limitation was the use of a college-student sample, which could pose a threat to the generalizability of these findings to other environments. However, this possible limitation may not be as important of an issue given that research has shown college-student samples to be appropriate for studying basic psychological processes such as creative cognition (Greenberg, 1987; Highhouse, 2009; Mook, 1983). Further, the problems used in this study were chosen based on their relevance to the student sample. Thus, the findings from this study imply that when individuals in other environments face problems that are relevant to them, psychological mechanisms similar to the ones identified in this study would be used.

Future Directions

Future research should more closely examine how task affects problem construction within the everyday problem solving domain. In this study, findings across the two problems were varied, thus suggesting a task effect. It could be the case that some problems are more conducive to creativity than others, but it may be too early to tell with just the results of this study alone. Moreover, we know that ambiguity and ill definition are important for creativity, but are there others? Researchers should also consider looking beyond domain specificity, and examine other factors that could influence the relationship between problem construction and creativity. For instance, construal or psychological meaningfulness has explained phenomena in other fields of psychology such as personality (Mischel & Shoda, 1998). Consequently, in addition to looking at domain specificity, creativity researchers interested in creative cognition should also consider problem elements that could influence how people perceive and interpret problems.

In the current study, participants actively engaged in problem construction by generating problem constructions on their own. It might also be useful to compare this approach to one in which participants are randomly presented problem constructions that vary in levels of quality and originality, and to examine how this presentation would influence subsequent solution creativity while controlling for problem construction ability. Such a design would allow for examining whether people who are creative are able to still generate creative solutions even if they were presented noncreative (i.e., low quality, low originality) problem constructions.

Finally, future research should consider the influence that individual differences could have on the relationship between problem construction and creativity. Because individual differences have been shown to influence the way we interpret and make sense of our environments (Bar-Haim, Lamy, Paragamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Derryberry & Reed, 1994; Downey & Feldman, 1996), there is reason to believe that that individuals differences could play a key role during problem construction.

Conclusion

In summary, the findings from this study provided additional evidence demonstrating that problem construction is beneficial to creative problem solving. In addition, we also showed that there was a curious link between the quality and originality of the problem construction process and the quality and originality solutions, which suggested that this relationship may be influenced by the problem itself. This is a novel finding in research on problem construction and creativity, which should be explored in future research, and has important implications for the study of creative cognition.

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