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**Use of creative cognition and positive affect in studying:
Evidence of a reciprocal relationship**

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Abstract

This two-wave study examined the longitudinal relationships between positive affect in studying and the use of creative cognition in studying. Based on the broaden-and-build theory of positive emotions, the mood-as-input model, the control-process model of self-regulation of intentional behavior, and self-determination theory, it was hypothesized that positive affect will be both an antecedent and a consequence of the use of creative cognition. A sample of 130 university students completed the International Positive and Negative Affect Schedule - Short Form (I-PANAS-SF) and the Use of Creative Cognition Scale (UCCS) with reference to their overall studying experience in the first and second semesters of an academic year. A comparison of alternative structural equation models showed clear support for the reciprocal relationship between positive affect in studying and the use of creative cognition in studying. The theoretical and practical implications of these findings are outlined.

Keywords: Creativity; Emotions in Studying; Positive Affect; University Students; Use of Creative Cognition.

Introduction

For decades, research on students' emotions in the learning context has focused on test and evaluation anxiety (e.g., Zeidner, 1998). In the last decade, educational psychologists started investigating the function of a wide range of positive and negative emotions that students experience in studying, importing the construct of affect from the field of personality and social psychology. Affect is a conceptual umbrella for both moods and emotions, mapping them onto a bipolar (positive-negative) valence dimension and differentiating them according to their level of activation (high-low) (Russell & Carroll, 1999). An important finding of the research conducted on students' affect is that positive affect in studying predicts better academic performance and is a stronger predictor of learning than negative affect is (e.g., Rogaten, Moneta, & Spada, 2013; Saklofske, Austin, Mastoras, Beaton, & Osborne, 2012). However, little is known about what factors influence positive affect in studying and how they can be intervened on in order to facilitate students' learning and academic performance.

A variable that has been systematically linked to positive affect in achievement contexts is creativity (e.g., Amabile, Barsade, Mueller, & Staw, 2005; Isen, 1998). Creativity research has traditionally focused on capturing individual differences in creative ability (e.g., Fekken, 1985; Torrance, 1998). Recently, researchers have developed a keen interest in the individual's tendency to deploy one's creative ability to an achievement context (Miller, 2009; Rogaten & Moneta, in press).

Creative ability and context-dependent use of creative cognition are related but distinct constructs. Although a certain level of creative ability is needed in order to deploy creative cognition, it is possible that some people high in creative ability do not typically use their creative cognition in work or study contexts, whereas some people low in creative ability do. We

propose that it is the use of creative cognition in a context – rather than creative ability per se – that fosters, and is fostered by the positive affect experienced in that context.

Within the creative cognition framework (Finke, Ward, & Smith, 1992) a range of cognitive processes were identified as potentially leading to creativity, such as divergent and convergent thinking (e.g., Cropley, 1999, 2006), metaphorical and analogical thinking (e.g., Runco, 1991; Sanchez-Ruiz, Santos, & Jiménez, 2013), and perspective taking (Davis, 2004). These processes can be collectively labeled and measured as creative cognition (Miller, 2009; Rogaten & Moneta, in press). The present study investigates the reciprocal relationship between positive affect and the use of creative cognition on university students using a two-wave (semester 1, semester 2) study design.

Positive Affect as a Facilitator of the Use of Creative Cognition

Experimentally induced positive mood has been found to result in more flexible (Hirt, Levine, McDonald, Melton, & Martin, 1997; Hirt, 1999) and inclusive (Isen & Daubman, 1984) categorization of information, more cognitive flexibility (Hirt, Devers, & McCrea, 2008), and more divergent thinking (Fernández-Abascal & Díaz, 2013; Vosburg, 1998). Therefore, positive affect appears to facilitate various processes under the umbrella of creative cognition within the limited follow-up time of an experiment.

Experimental evidence has been corroborated by diary studies conducted on workers in their occupational settings for one or more consecutive weeks. In particular, Amabile and co-workers (2005) found that positive affect on any given workday predicted creative thought – which can be regarded as a general indicator of the use of creative cognition – on the same day as well as on the following two days. These findings were corroborated by Bledow, Rosing and Frese (2013) in a study of positive affect and self-rated creativity at work. As such, positive

affect appears to facilitate the use of creative cognition within a workday and spanning across two workdays, and the facilitation holds within-person in endeavors that may last for weeks.

The found effects of positive affect on the use of creative cognition are consistent with the *broaden-and-build theory* of positive emotions (Fredrickson, 1998, 2001) and the *mood-as-input model* (Martin et al., 1993). The two theories in combination entail that positive affect in a task fosters creative cognition by virtue of expanding one's attention (Gasper & Clore, 2002), cognition (Fredrickson & Joiner, 2002), and thought-action repertoires (Johnson & Fredrickson, 2005), and prolongs the application of creative cognition to the task insofar as positive affect is interpreted as a sign that the activity is enjoyable. Therefore it was hypothesized that:

(H1) Positive affect in studying in semester 1 will be positively associated with the use of creative cognition in studying in semester 2.

The Use of Creative Cognition as a Facilitator of Positive Affect

The predictive effects of the use of creative cognition on positive affect have rarely been studied. Amabile and co-workers (2005) tested for lagged effects of self-rated creative thought of the workday on positive affect of the workday and found none. However, they found evidence of lagged effects in a qualitative analysis of open-ended descriptions of the workday. They identified a set of narratives in which employees referred to having generated novel ideas or solved problems creatively, identified employees' emotional reactions, and determined whether the narrated emotions either anticipated or followed the creative work that had been referred to. The analysis revealed that creative work was often followed by the positive emotions of "Eureka", pride, and relief. Based on interviews of product inventors, Henderson (2004) identified four themes that outline possible paths through which the use of creative cognition can foster positive affect: affective pleasure in technical perspective taking (e.g., probing through

imagination aesthetic and functionality of a potential product), affective pleasure in focus, affective pleasure in creating, and affective pleasure in self-expression. These qualitative findings are in line with the theoretical argument put forth by many researchers (e.g., Kurtzberg, 2005; Seligman & Csikszentmihalyi, 2000) that the perception of doing creative work leads to satisfaction, fulfillment, and heightened self-esteem, and hence positive emotions.

Amabile and co-workers (2005) argued that the failure to establish the link creativity – positive affect in their quantitative analysis was due to positive emotions that followed the creative activity being often offset by unfavorable feedback from supervisors and peers. This suggests that the emotional consequences of the use of creative cognition are a mixture of task-inherent emotions (e.g., pride for having creatively solved a difficult problem) and social-outcome emotions that stem from other people's reactions to one's own novel contribution.

The task-inherent emotional consequences of the use of creative cognition can be inferred from the *control-process model* of self-regulation of intentional behavior (Carver & Scheier, 1990, 2000) and *self-determination theory* (Deci & Ryan, 1985; Ryan & Deci, 2000). The two theories in combination entail that the use of creative cognition fosters positive affect because it often accelerates progression toward the goal and increases one's self-determination, which results in heightened intrinsic motivation and hence positive affect throughout and after the endeavor. Therefore it was hypothesized that:

(H2) The use of creative cognition in studying in semester 1 will be positively associated with positive affect in studying in semester 2.

Method

Participants and Procedure

An opportunity sample of 148 students from a London University took part in this two-wave study. For each participant, the data were gathered in semester 1 (first wave) and semester 2 (second wave) of the academic year. The invitation letter, information sheet with explanations of the purpose of the study and its procedures, and the hyperlink to the survey (implemented in SurveyMonkey) were sent to students' university e-mail addresses. Only 130 participants – 30 (23.1%) males and 100 (76.9%) females with age range 18 to 52 ($M = 24.9$; $SD = 7.4$) – completed both waves of data collection and were retained for the analysis. There was no difference in positive affect and use of creative cognition in semester 1 between dropouts and final sample. Students were from various faculties within the university: 70 (53.8%) from the Faculty of Life Science and Computing and 60 (46.2%) from the Faculties of Social Science, Business, Law and Humanities; 102 (78.5%) were undergraduate students and 25 (19.2%) were graduate students. There were 70 (53.9%) White students and 60 (46.9%) students from other ethnic backgrounds, predominantly Asians and Blacks.

Measures

Use of Creative Cognition Scale (UCCS) in Studying is a 5-item self-reported questionnaire measuring the tendency to deploy creative cognition to problem solving in studying (e.g., “I find effective solutions by combining multiple ideas”). Responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The UCCS was derived from the Cognitive Processes Associated with Creativity (CPAC; Miller, 2009) scale, and retained representative items from four CPAC facets (Idea Manipulation, Idea Generation, Imagery/Sensory Cognitive Strategy, and Metaphorical/Analogical Thinking) to form a scale that

is unidimensional and has good construct validity. The UCCS has internal consistency of .82, and has good concurrent validity through positive correlations with flow in studying, adaptive metacognitive traits, and trait intrinsic motivation (Rogaten & Moneta, in press).

Positive and Negative Affect Schedule (PANAS) – Short Form (I-PANAS-SF) is a list of ten adjectives, five measuring positive affect (e.g., “attentive”) and five measuring negative affect (e.g., “nervous”), which were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The I-PANAS-SF 8-week test-retest reliabilities were .84 for both scales, and the internal consistency was .74 for negative affect and .80 for positive affect in the original validation study (Thompson, 2007). The I-PANAS-SF has good concurrent validity through positive correlations of positive affect, and negative correlations of negative affect, with measures of happiness and subjective well-being (Thompson, 2007).

Data Analysis

The research hypotheses were tested in a reciprocal path model where the temporal stabilities of study variables, cross-sectional correlations between positive affect and the use of creative cognition in semester 1 and semester 2 as well as random measurement error and measurement method biases were controlled for. The hypothesized and alternative models were tested using structural equation modeling as implemented in LISREL 8.8 (Jöreskog & Sörbom, 1996). Positive affect and the use of creative cognition were defined as latent variables, and their respective constituent items were defined as congeneric indicators of the latent variables. In all models, the measurement model allowed the individual item errors to correlate across the semester 1 and semester 2 administrations (e.g., the measurement error of one item measuring the use of creative cognition in semester 1 was allowed to covary with the measurement error of the same item in semester 2) in order to account for the method variance of each item (Pitts,

West, & Tein, 1996), and hence obtain the best possible measurement model as a platform to test and compare the structural relationships of the hypothesized and alternative models.

Four competing structural equation models were estimated. The *stability model* (Model 1) specifies temporal stabilities between semester 1 positive affect and semester 2 positive affect and between semester 1 use of creative cognition and semester 2 use of creative cognition as well as cross-sectional correlations between positive affect and the use of creative cognition; this model explains change of positive affect and the use of creative cognition merely in terms of inherent temporal stability of the measures, random error, and method bias, and hence does not hypothesize causal relationships between positive affect and the use of creative cognition. The *causality model* (Model 2) has paths identical to the stability model (Model 1) but additionally includes a cross-lagged structural path from semester 1 positive affect to semester 2 use of creative cognition; this model tests hypothesis 1 controlling for temporal stabilities. The *reversed causality model* (Model 3) has paths identical to the stability model (Model 1) but additionally includes a cross-lagged structural path from semester 1 use of creative cognition to semester 2 positive affect; this model tests hypothesis 2 controlling for temporal stabilities. Finally, the *reciprocal model* (Model 4) has paths identical to the stability model (Model 1) but additionally includes both a cross-lagged structural path from semester 1 positive affect to semester 2 use of creative cognition and a cross-lagged structural path from semester 1 use of creative cognition to semester 2 positive affect; this model tests simultaneously hypothesis 1 and hypothesis 2 controlling for temporal stabilities.

The four models were compared by means of the chi-square difference test (Jöreskog & Sörbom, 1996). Furthermore, the fit of each model was evaluated using the following indices, with Hu and Bentler's (1999) cutoff values for satisfactory fit: the Comparative Fit Index (CFI)

and the Non-Normed Fit Index (NNFI) with the cutoff value of .95, the Standardized Root Mean Square Residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA) with the cutoff value of .08.

Results

Descriptive Statistics

The means, standard deviations, correlations coefficients, and Cronbach's alpha coefficients of the study variables are presented in Table 1. Both scales measuring positive affect and the use of creative cognition had satisfactory internal consistency above .70 at both measuring points, and had fair one-semester test-retest reliabilities exceeding .50. The contingent correlations between positive affect and the use of creative cognition were moderate and in line with scale validation findings (Rogaten & Moneta, in press). The cross-lagged correlations between positive affect and the use of creative cognition were positive, moderate, and consistent with both hypotheses.

 Insert Table 1 about here

Model Testing

The goodness-of-fit indices of all four competing models are presented in Table 2. The stability model (Model 1) had acceptable fit and provided estimates of one-semester test-retest reliability controlled for measurement error and method bias: .57 for positive affect and .71 for the use of creative cognition. The remaining three models showed model fit in the acceptable-good range. The causality model (Model 2) was superior to the stability model (Model 1) ($\chi^2(1) = 5.3, p = .021$), implying that the cross-lagged path from semester 1 positive affect to

semester 2 use of creative cognition was significant. The reversed causality model (Model 3) failed by a small margin to outperform the stability model (Model 1) (Delta $\chi^2(1) = 3.8, p = .051$), implying that the cross-lagged path from semester 1 use of creative cognition to semester 2 positive affect was not significant. Finally, the reciprocal model (Model 4) was superior to the stability model (Model 1) (Delta $\chi^2(2) = 9.67, p = .008$), the causality model (Model 2) (Delta $\chi^2(1) = 4.37, p = .037$), and the reversed causality model (Model 3) (Delta $\chi^2(1) = 5.87, p = .015$), implying that both the crossed-lagged path from semester 1 positive affect to semester 2 use of creative cognition and the cross-lagged path from semester 1 use of creative cognition to semester 2 positive affect were significant. In all, the hypothesized reciprocal model (Model 4) was the best fitting of the four models.

 Insert Table 2 about here

Figure 1 shows the estimated reciprocal model with standardized path coefficients and factor loadings of the latent variables. The model explained 52% of variance in semester 2 use of creative cognition and 37% of variance in semester 2 positive affect. Both the crossed-lagged path from semester 1 positive affect to semester 2 use of creative cognition and the cross-lagged path from semester 1 use of creative cognition to semester 2 positive affect were positive and significant, lending support to hypothesis 1 and hypothesis 2, respectively.

 Insert Figure 1 about here

Discussion

The findings of this study support both hypotheses and suggest that positive affect in studying and the use of creative cognition in studying have a reciprocal causal relationship. As highlighted in the introduction, there is an asymmetry between the two causal relationships in terms of the empirical support they have received to date. On the one hand, the relationship from positive affect to the use of creative cognition has received robust support in both experimental studies and longitudinal studies on workers in their organizational settings. As such, the finding that this relationship holds for students in university settings is a small addition to knowledge. On the other hand, the relationship from the use of creative cognition to positive affect has been under researched and has proven elusive in quantitative analyses. As such, the finding that this relationship holds for students in university settings is an important addition to knowledge and prompts the question: why does the relationship hold for students and does not hold for workers?

It is difficult to pinpoint a specific answer because working and studying differ in nature and environmental factors. Nevertheless, Amabile and co-workers' (2005) qualitative analysis suggests a plausible explanation for the existence of a use of creative cognition – positive affect relationship in study settings and for its absence in at least certain work settings. On the one hand, for the challenging team project work investigated by Amabile and co-workers creativity was both possible and desirable. This made creative performance normative, and the link creativity-performance explicit. As such, it is understandable that the successful use of creative cognition was followed by both task-inherent positive emotions (e.g., pride) and social-outcome negative emotions (e.g., dejection due criticism made by competing others). On the other hand, the sample of students in the present study was recruited from a university that does not explicitly consider creativity in its marking criteria, which makes creative performance non-

normative, optional, and virtually risk-free. As such, it is likely that the successful use of creative cognition in studying was followed mainly by task-inherent positive emotions. This speculative interpretation implies that the creativity-performance normative link (i.e., the environmental pressure to be creative in one's own work or study) moderates the relationship between the use of creative cognition and positive affect in such a way that the stronger the link is, the weaker the relationship will be.

The longitudinal relationship found in the present study between the use of creative cognition in studying and subsequent positive affect in studying opens novel possibilities for educational intervention. Prior studies have consistently indicated that the positive affect students experience when engaging in study activities predicts better academic performance even when controlling for the effect of prior academic performance, whereas negative affect predicts worse academic performance (e.g., Rogaten, Moneta, & Spada, 2013; Saklofske, Austin, Mastoras, Beaton, & Osborne, 2012). Moreover, positive affect in studying has been found to prevent subsequent negative affect in studying (Moneta, Vulpe, & Rogaten, 2012), making positive affect in studying a core target variable for intervention. In particular, training programs that foster the use of creative cognition in studying could increase students' positive affect in studying and, in turn, improve their academic performance.

The findings of this study should be evaluated in the light of four key methodological limitations. First, the data were gathered using an online survey, a technique that is open to the risk of sampling frame and self-selection bias (Wright, 2005). Second, although the longitudinal design of this study partly alleviates the problem of common method bias (Podsakoff, Mackenzie, Lee, & Podsakoff, 2003), the self-reported nature of the data could have inflated the strength of the reciprocal relationship between positive affect and the use of creative cognition.

Third, a two-wave design can only suggest causality; this is particularly the case for a reciprocal model, as a third, unmeasured variable might be a cause or a mediator of both variables involved in the reciprocal relationship. Finally, a two-wave design with a relatively short follow-up time does not support inferences concerning the dynamics and long-term development of the found reciprocal relationship.

The last point has two important implications for future research. Firstly, it would be tempting to interpret the found reciprocal relationship as evidence of the existence of upward positive and downward negative spirals. In particular, experiencing an increase in positive affect might increase the use of creative cognition, which in turn might further increase positive affect, which might then create an upward spiral of positivity. In a similar vein, experiencing a decrease in positive affect might decrease the use of creative cognition, which might further decrease positive affect, and hence a downward spiral of negativity would be created. However, these hypothetical spirals might not occur because of ceiling effects, coasting effects, and habituation. As such, they can only be tested in future research using a randomized trial design with sufficiently long follow-up time and numerous repeated measures.

Secondly, the present study has ignored the possible role of negative affect. Bledow and co-workers (2013) have developed and tested a model of optimal alternation of affective states at work. In essence, they argued that negative affect fosters task creativity if it is high at the onset and then sharply decreases while positive affect sharply increases, which constitutes the *Phoenix* affective shift. By analogy, it is possible that the same happens in the learning context. However, the detection and testing of the *Phoenix* or other forms of affective shift requires more complex longitudinal and experimental study designs.

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Table 1.

Means, standard deviations, correlation coefficients, and Cronbach's alpha coefficients (in parentheses) of the study variables.

| Variable | <i>X</i> | <i>SD</i> | 1. | 2. | 3. | 4. |
|-----------------------|----------|-----------|--------|--------|--------|-------|
| <i>Semester 1</i> | | | | | | |
| 1. Positive Affect | 3.67 | 0.72 | (.74) | | | |
| 2. Creative Cognition | 3.70 | 0.68 | .467** | (.82) | | |
| <i>Semester 2</i> | | | | | | |
| 3. Positive Affect | 3.70 | 0.71 | .506** | .433** | (.78) | |
| 4. Creative Cognition | 3.76 | 0.78 | .445** | .601** | .528** | (.89) |

Notes. $n = 130$. Range of the response scales: 1-5. ** $p < .01$ (1-tailed).

Table 2.

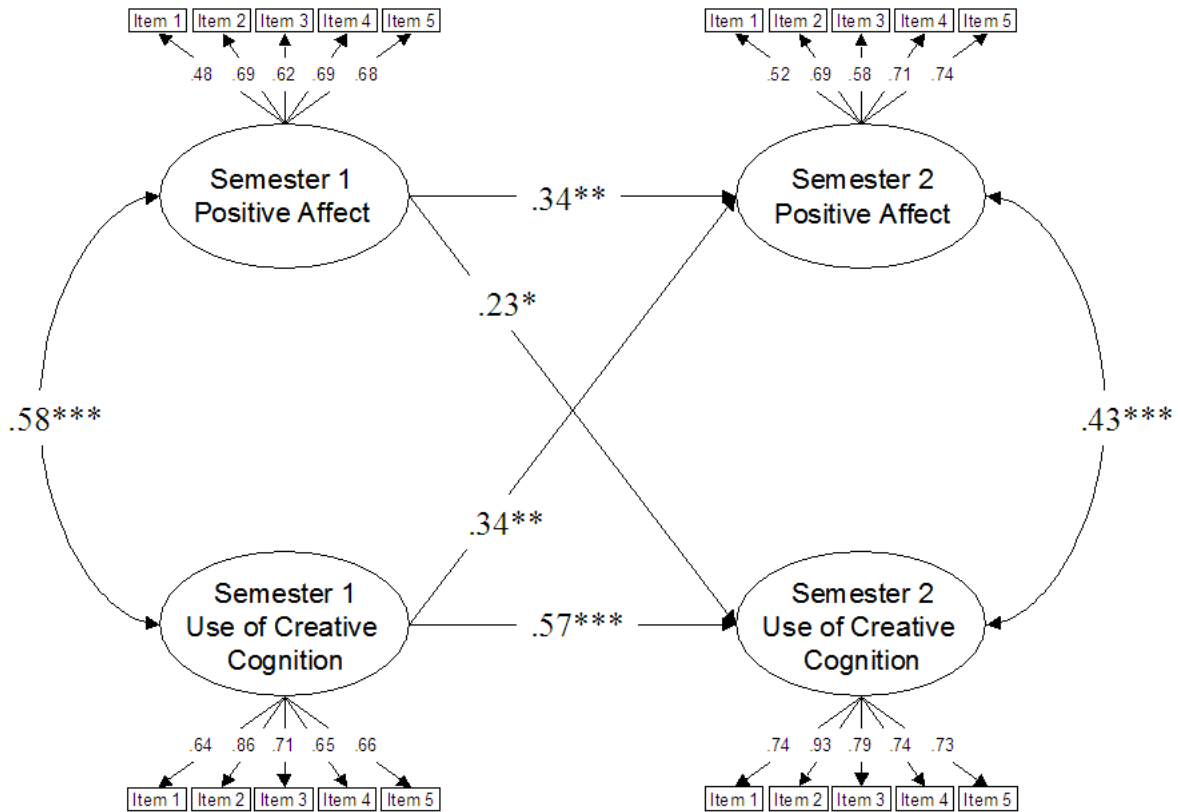
Goodness-of-fit indices for the alternative positive affect – use of creative cognition models.

| Model | χ^2 | df | <i>p</i> | RMSEA | CFI | NNFI | SRMR |
|-----------------------------------|----------|-----|----------|-------|-----|------|------|
| Model 1: Stability model | 218.32 | 157 | .001 | .055 | .97 | .96 | .095 |
| Model 2: Causality model | 213.02 | 156 | .002 | .053 | .97 | .97 | .083 |
| Model 3: Reversed causality model | 214.52 | 156 | .001 | .054 | .97 | .97 | .074 |
| Model 4: Reciprocal model | 208.65 | 155 | .003 | .052 | .97 | .97 | .070 |

Note. χ^2 = chi-square; df = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; SRMR = Standardized Root Mean Square Residual.

Figure 1.

The estimated reciprocal positive affect – use of creative cognition model with standardized path coefficients, cross-sectional correlations, and factor loadings of the latent variables.



* $p < .05$ (1-tailed); ** $p < .01$ (1-tailed); *** $p < .001$ (1-tailed).