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Positive and negative structures and processes

underlying academic performance: A chained mediation model

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Authors' Note

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Abstract

This study proposed and tested a comprehensive, chained mediation model of university students' academic performance. The hypothesized model included adaptive-positive and maladaptive-negative submodels. The structures and processes in the adaptive-positive submodel were hypothesized to facilitate students' academic performance, whereas the structures and processes in the maladaptive-negative submodel were hypothesized to undermine it. A sample of 373 university students completed a set of questionnaires measuring their approaches to studying, positive and negative affect, evaluation anxiety, use of creative cognition, motivational orientations, and adaptive and maladaptive metacognitions. Participants' end-of-semester and prior semester academic performance was retrieved from the university registry. A structural equation model explained 90% of the variance in students' future academic performance, supported all but one hypothesized intermediate paths, and revealed that only positive affect in studying and prior academic performance predict directly future academic performance. The theoretical and practical implications of these findings are outlined.

Keywords: academic performance, approaches to studying, evaluation anxiety, metacognition, motivation, negative affect, positive affect, university students, use of creative cognition.

Introduction

Research within Higher Education has traditionally been concerned with psychological variables that undermine learning, and has paid less attention to psychological variables that facilitate learning. For example, there are over 200 studies that looked at the effect of evaluation/test anxiety on learning (Zeidner, 1998), and only a handful of studies that looked at the effect of positive emotions on learning (e.g., Pekrun, Frenzel, Goetz, & Perry, 2007; Pekrun, Goetz, Titz, & Perry, 2002). There has also been a scarcity of empirical research that considers simultaneously the effects of psychological variables that undermine and facilitate learning. In order to start filling this gap, the present study developed and tested a comprehensive, chained mediation model of academic performance that examines simultaneously positive-adaptive and negative-maladaptive structures and processes underlying learning. It is hoped that the development of such a modeling approach will help to prevent educational interventions from being biased toward either negative-maladaptive or positive-adaptive psychological variables, and to identify the primary target variables for interventions aimed at improving students' chances of success in Higher Education.

The present study chose academic performance as the measure of learning for the following reasons: (a) it is universally recognized as the most appropriate measure of learning, (b) it is free from self-report biases, (c) it allows a direct comparison of research findings with the results of other studies, and (d) standardized assessments allow direct comparisons between students (e.g., Anaya, 1999; Bowman, 2010; Gonyea, 2005). Educational research has consistently found that prior academic performance is the strongest predictor of future academic performance (e.g., Diseth, 2007; Duff, 2004; Zeegers, 2004). Therefore, the present study examined the effects of psychological variables on future academic performance controlling for the effect of prior academic performance. The inclusion of past performance as a control variable in the model implies that the outcome variable of

this study is progress (or regression) in academic performance relative to students' prior academic performance.

The empirical studies conducted to date have identified a large number of psychological variables that correlate with academic performance in Higher Education (e.g., see reviews by Hattie, 2009, and Richardson, Abraham, and Bond, 2012). The large majority of these variables are specific to the educational context (e.g., use of study aids, attitude toward studying, or test-taking strategies). Departing from such a context-specific approach, the present study selected only key context-specific psychological variables (i.e., approaches to studying and evaluation anxiety) and included instead a set of general psychological variables that have been researched systematically in a wide range of fields of psychological enquiry – in particular, personality and social psychology, work psychology, and clinical psychology – and that are closely linked to general theories of psychological functioning. This was done based on the belief that at this stage of scientific development there is a strong need of integrating educational psychology with other major fields of psychology. This integrative approach was pursued in prior studies (e.g., Rogaten, Moneta, & Spada, 2013; Spada & Moneta, 2012, 2014) by using subsets of the variables considered here. Most of the relationships investigated in the present study have already been tested in a piecewise fashion on different student samples. The present study seeks the development and testing of a comprehensive model that integrates all the hypothesized relationships.

From the personality psychology perspective, all psychological variables can be viewed as either processes or structures. Processes are variables that signify the variability of behavior within a person in response to different situations, whereas structures are variables that signify the similarity or average tendency of an individual's behavior across situations and times (e.g., Fleeson, 2001; McAdams, 1995). All the variables selected for the model of this study were classified as either processes or structures based on their underlying theory

and the properties of their measurement scales, chiefly stability and domain dependence. The core modeling principle adopted in this study is that processes should be the direct predictors of academic performance, whereas structures should influence academic performance indirectly, by influencing processes.

Typically, the variables and hypotheses constituting a chained mediation model are presented starting with the predictors (structure variables), followed by the first-order mediators (process variables), and ending with the second-order mediators (process variables). However, in the hypothesized model of this paper the structure variables have numerous relationships with other variables in the model. Therefore, when stating the hypotheses for the structure variables one would need to define all the process variables that are predicted by them. Therefore, for the sake of clarity and conciseness we will construct the model in a backward fashion, first considering the process variables and then the structure variables.

Processes that predict academic performance

Approaches to studying

Students' Approaches to Learning (SAL) theory (Entwistle, Hanley, & Hounsell, 1979) states that there are three main approaches to studying: deep, strategic, and surface. These can be broadly categorized into adaptive and maladaptive. Deep and strategic approaches to studying are characterized by deep interpretation and analysis of new information and by target-oriented attitudes toward learning, respectively, and hence are adaptive. Surface approach to studying is characterized by rote-learning and shallow understanding of study material (Entwistle & Peterson, 2004), and hence is maladaptive. A study that administered measurement scales derived from SAL theory and other theoretical perspectives found strong convergence among the items from the different scales that transcend theoretical differences and consolidate the description of the three approaches to

studying (Speth & Brown, 2011): (a) the deep approach implies an intention to understand, personalize, and integrate the information being learned with prior knowledge; (b) the strategic approach implies a tendency to integrate from the start the information being learned with contextual cues, particularly those concerning assessment; (c) the surface approach implies a tendency to reproduce unselectively the learning material without personal involvement, and to ignore contextual cues.

Students' approaches to studying may change as a result of a change in the educational environment, particularly in assessment methods (e.g., Kember & Gow, 1994; Marton & Säljö, 1976b), or following study skills interventions (Norton & Crowley, 1995; Solomonides & Swannel, 1995), and hence qualify as process variables. Consistent with SAL theory, strategic approach and, to a lesser extent, deep approach positively correlate with academic performance, whereas surface approach negatively correlates with academic performance (e.g., Byrne, Flood, & Willis, 2002; Diseth, 2007; Diseth, Pallesen, Brunborg, & Larsen, 2010). Therefore, it was hypothesized that:

H1: *(a) Strategic and (b) deep approaches to studying will positively correlate with academic performance, whereas (c) surface approach to studying will negatively correlate with academic performance.*

Affect

Affect is the most general and primitive construct in emotional research (Russell, 2003) and is a conceptual umbrella for both moods and emotions (Wyer, Clore, & Isbell, 1999). Positive affect includes emotions like love, interest, contentment, whereas negative affect includes emotions like anger, fear, and disgust (Fredrickson, 1998).

Three theories of emotions provide suggestions on how to position positive and negative affect within the model of academic performance. First, *control-process theory* (Carver & Scheier, 1990, 2001) postulates that affect works as a signal of progress and a

regulator of effort in achievement endeavors, in such a way that if progress is faster than desired, the individual will experience positive affect, whereas if progress is slower than desired, the individual will experience negative affect. Second, the *mood-as-input theory* (Martin, Ward, Achee, & Wyer, 1993) posits that affect guides the start and stop mechanisms of intentional behavior as follows: (a) positive mood prolongs engagement with an activity if the objective in pursuing the activity is enjoyment, and shortens engagement if the objective is goal attainment; (b) negative mood shortens engagement with an activity if the objective is enjoyment, and prolongs engagement if the objective is goal attainment. Finally, the *broaden and build model* of positive emotions (Fredrickson, 1998, 2001) postulates that positive emotions broaden thought-action repertoires through enhancing cognition (Fredrickson & Branigan, 2005; Fredrickson & Joiner, 2002) and expanding the scope of attention (Gasper & Clore, 2002) (*broaden hypothesis*), and that positive emotions – even short-lived ones – have long-term positive effects by increasing physical, psychological, and social resources (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009) (*build hypothesis*).

The stability of the positive and negative affect students experience in studying across consecutive two semesters was found to be moderate (Rogaten & Moneta, 2015b), indicating that affect in studying is a process variable. Consistent with the outlined theories of emotions, students' positive affect in studying was found to correlate positively with academic performance, whereas negative affect was found to correlate negatively (e.g., Dosseville, Laborde, & Scelles, 2012; Rogaten, Moneta, & Spada, 2013). Therefore, it was hypothesized that:

H2: (a) *Positive affect in studying will positively correlate with academic performance, whereas (b) negative affect in studying will negatively correlate with academic performance.*

Creative thinking

Creativity was identified as an important process in learning and a strong correlate of positive affect (e.g., Baas, De Dreu, & Nijstad, 2008; Isen, Daubman, & Nowicki, 1987). Following recent developments in creativity research, we were interested in examining the effect of context-dependent use of creative thinking in studying. We previously argued that creative ability and context-dependent use of creative cognition are related but distinct constructs (Rogaten & Moneta, 2015a, 2015b). Although a certain level of creative ability is needed in order to deploy creative cognition, it is possible that some students high in creative ability do not typically use their creative cognition in study contexts, whereas some students low in creative ability do (Rogaten & Moneta, 2015b). The following cognitive processes related to creativity were identified: divergent and convergent thinking, metaphorical and analogical thinking, perspective taking, and imagery (for a review see Davis, 2004). Keeping in mind that everyone can use creative cognition more or less effectively in their studying, but not necessarily do so, the use of creative cognition in studying is a process variable.

Students who use their creative cognition in studying should understand the subject matter better and learn faster, and hence experience more positive affect in studying. In support of this conjecture, the use of creative cognition in a semester was found to predict positive affect in the following semester (Rogaten & Moneta, 2015b). The relationship between the use of creative cognition and approaches to studying has not yet been investigated. Nevertheless, the use of creative cognition should promote the development of adaptive approaches to studying. For instance, metaphorical and analogical thinking and perspective-taking, which facilitate manipulation and transformation of ideas that result in new knowledge (Davis, 2004), are likely prerequisites of deep processing of information, and hence should facilitate the adoption of the deep approach to studying. Moreover, divergent and convergent thinking are two thinking strategies that enable individuals to come up with

multiple ideas, and then narrow down the selection to one idea that meets the requirements of the problem at hand. This type of target-oriented thinking is a distinct characteristic of strategic learners (Entwistle & Peterson, 2004; Ramsden, 1979). As such, the use of creative cognition in studying should also facilitate the adoption of the strategic approach to studying. Therefore, it was hypothesized that:

H3: *Use of creative cognition in studying will positively correlate with (a) positive affect in studying, (b) strategic and (c) deep approaches to studying.*

Evaluation anxiety

Evaluation anxiety has been traditionally regarded as the key affective process variable undermining learning (e.g., Fleeson, 2001; McAdams, 1995; Spielberger & Vagg, 1995). Evaluation anxiety is anxiety that is specific to the situations where one's performance can be negatively evaluated by others (Geen, 1991), and is an umbrella term for different types of anxiety, such as test anxiety, statistical test anxiety, and performance anxiety (Skinner & Brewer, 1999; Zeidner & Matthews, 2005). Evaluation anxiety and its different sub-forms were found to undermine cognitive efficiency – particularly by reducing working memory and attention – and academic performance (see review by Zeidner, 1998). Evaluation anxiety was consistently found to correlate with surface approach to studying (Cermakova, Moneta, & Spada, 2010; Moneta, Spada, & Rost, 2007; Spada & Moneta, 2012, 2014). Finally, test-anxious students were found to experience higher levels of negative emotions, particularly shame and guilt (Arkin, Detchon, & Maruyama, 1982; Stowell, Tumminaro & Attarwala, 2008). Therefore, it was hypothesized that:

H4: *Evaluation anxiety will positively correlate with (a) surface approach to studying and (b) negative affect in studying.*

Structures that predict processes

Motivational orientations

Self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000) postulates that motivation is the core process and structure underlying learning. Intrinsic motivation is the tendency to engage in tasks because one finds them interesting, challenging, and enjoyable, whereas extrinsic motivation is the tendency to engage in tasks because of task-unrelated factors such as anticipation of rewards, surveillance, and competition (Deci & Ryan, 1985; Ryan & Deci, 2000). Intrinsic and extrinsic motivation were originally conceptualized as state variables that change across situations and times and are incompatible with each other at any given time. Amabile and co-workers (Amabile, Hill, Hennessey, & Tighe, 1994) have later defined and operationalized intrinsic and extrinsic motivation as independent traits to be driven either by the engagement of work or by a means to some end that is external to the work itself.

From its inception, SAL theory posited that the deep approach to studying is driven to intrinsic motivation (derived from interest in the subject matter), whereas the surface approach to studying is driven by extrinsic motivation (derived from an inner pressure to memorize the unconnected details of the subject matter), and found evidence of these associations in factor and cluster analyses of items measuring states (Entwistle & Wilson, 1977). When measured as traits, intrinsic motivation was consistently found to correlate with the deep approach to studying, whereas extrinsic motivation was found to correlate with the surface approach to studying (e.g., Moneta & Spada, 2009; Prat-Sala & Redford, 2010; Spada & Moneta, 2012, 2014). Therefore, it was hypothesized that:

H5: *Trait intrinsic motivation will positively correlate with (a) deep approach to studying, whereas trait extrinsic motivation will positively correlate with (b) surface approach to studying.*¹

Intrinsic motivation implies appreciation of complexity, including task novelty, as an opportunity to explore, play with ideas, and acquire mastery (Deci & Ryan, 1985), and hence should foster the use of creative cognition. Extrinsic motivation energizes behavior by arousing ego-involving anticipations of success or failure (Deci & Ryan, 1985), and hence should foster evaluation anxiety. Consistent with these arguments, trait intrinsic motivation was found to correlate with creative output in a wide range of tasks (e.g., Amabile, Hennessey, & Grossman, 1986; Hennessey et al., 1989), and with the use of creative cognition in studying (Rogaten & Moneta, 2015a), whereas trait extrinsic motivation was found to correlate with evaluation anxiety (Spada & Moneta, 2012, 2014). Therefore, it was hypothesized that:

H6: *Trait intrinsic motivation will positively correlate with (a) use of creative cognition in studying, whereas trait extrinsic motivation will positively correlate with (b) evaluation anxiety.*

General metacognitions

Metacognition is a multidimensional construct (e.g., Antonietti, Ignazi, & Perego, 2000; Wells, 2002) that encompasses psychological structures, beliefs, and control functions that enable an individual to interpret and modify one's own thinking (Flavell, 1979).

Metacognition is essential for determining what strategies one can use to perform any learning task, such as identifying required skills, detecting potential obstacles, assessing time and effort costs, and estimating potential benefits (Antonietti et al., 2000). Metacognition in the educational context typically refers to a form of higher order thinking characterized by the

¹ No hypothesis was posited for the strategic approach to studying because both types of motivation may contribute to it depending on contextual factors that were not assessed in the present study.

ability to self-regulate cognitive processes in learning. Such processes include identifying effective ways of carrying out a task, monitoring comprehension, and assessing learning progress after completing a learning task (Schraw, 1998).

From a personality psychology perspective, metacognitions are relatively stable traits and can be broadly separated into adaptive and maladaptive, in that they either facilitate or hinder problem solving in challenging situations (Beer & Moneta, 2010, 2012). On the one hand, adaptive metacognition is theorized to foster flexible switching of attention from a perceived threat to the task at hand based on the strategic demands of the situation, agentic search for alternative pathways, and flexible goal restructuring (Beer & Moneta, 2010). When adaptive metacognition is activated, the thinking becomes flexible and adaptable. On the other hand, maladaptive metacognition is theorized to foster excessive threat monitoring, perseverative thinking, and maladaptive coping in response to external stimuli and to one's own internal states, and to maintain psychological dysfunction through these processes (Wells & Matthews, 1994; Wells, 2000). When maladaptive metacognition is activated, the thinking becomes negative, cyclical, and rigid.

The two metacognitions are likely to influence affect in studying and approaches to studying in diametrical ways. On the one hand, adaptive metacognition comprises the meta-emotions of interest and curiosity (Mitmansgruber, Beck, Höfer, & Schüßler, 2009) in one's own primary emotional responses to a challenging endeavor, in such a way that difficult tasks are construed as positive challenges (Beer & Moneta, 2010). Therefore, adaptive metacognition should foster positive emotions by enhancing the appraisal of difficult learning tasks. In support of this conjecture, adaptive metacognition was found to correlate with positive affect in studying (Moneta, 2012) and work (Mackay & Moneta, in press). The relationship between adaptive metacognition and approaches to studying has not yet been

investigated. Nevertheless, the ability to set flexible and feasible study goals and to set the mind for problem solving should foster deep and strategic approaches to studying.

On the other hand, maladaptive metacognition implies a focus on negative emotions and presumed or real environmental threats that trigger those negative emotions, rather than a focus on the task at hand (Wells & Matthews, 1994). Therefore, maladaptive metacognition should foster coping with negative emotions, with the consequence that leaving the real-world problem unattended typically results in even more negative emotions. Consistent with theory, maladaptive metacognition was found to foster negative emotions (Moneta, 2011) and to exacerbate the effect of perceived stress on negative emotions (Spada, Nikčević, Moneta, & Wells, 2008). Moreover, the excessive preoccupation with internal states and external threats should deplete attentional resources, and hence lead students to adopt a surface approach to studying. Indeed, maladaptive metacognition was consistently found to correlate with surface approach to studying (Moneta et al., 2007; Spada & Moneta, 2012, 2014; Spada, Nikcevic, Moneta, & Ireson, 2006). Therefore, it was hypothesized that:

H7: *Adaptive metacognition will positively correlate with (a) positive affect in studying, (b) strategic and (c) deep approaches to studying, whereas maladaptive metacognition will positively correlate with (d) surface approach to studying and (e) negative affect in studying.*

The two metacognitions are also likely to have diametrical consequences on the use of attentional resources in studying. On the one hand, adaptive metacognition should foster a focus on the learning task as an opportunity to perform creatively, and hence foster the use of creative cognition. In support to this reasoning, adaptive metacognition was found to correlate with the use of creative cognition in studying (Rogaten & Moneta, 2015a). On the other hand, maladaptive metacognition should foster a focus on the threat from anticipated failure to perform satisfactorily, and hence foster evaluation anxiety. Indeed, maladaptive

metacognition was consistently found to correlate with evaluation anxiety (Spada & Moneta, 2012, 2014; Spada et al., 2006). Therefore, it was hypothesized that:

H8: *Adaptive metacognition will positively correlate with (a) use of creative cognition in studying, whereas maladaptive metacognition will positively correlate with (b) evaluation anxiety.*

Goals of the study

Figure 1 shows the hypothesized chained mediation model of academic performance. The model comprises adaptive-positive and maladaptive-negative submodels. The adaptive-positive submodel includes psychological variables that are expected to foster academic performance, whereas the maladaptive-negative submodel includes psychological variables that are expected to undermine academic performance. The model contains 21 paths, of which 17 received some empirical support in prior studies and four are tested for the first time in this study. Previous studies tested only subsets of the variables and paths shown in the model. Testing the whole set of paths in a single model provides the opportunity to rule out spurious associations that may have received support because relevant competing variables were not controlled for. As such, the goals of the study are: (a) to test the model as a whole and each of its hypothesized links, and (b) to compare the two submodels in their ability to explain students' academic performance.

Insert Figure 1 about here

Method

Participants and procedures

An opportunity sample of 373 students from a London university, 93 (24.9%) males and 280 (75.1%) females with age range 18 to 54 years ($M = 25.6$, $SD = 7.6$), participated in

the study; 203 (54.4%) students were from the Faculty of Science and Computing, and 170 (45.6%) students were from the Business School, the Faculty of Social Science and Humanities, and the Faculty of Law and International Relations; 328 (87.9%) were undergraduate students, and 45 (12.1%) were postgraduate students; 190 (50.9%) students were White, 68 (18.2%) students were Black, and the remaining 115 (30.9%) students were from other or mixed ethnic backgrounds. The background of this sample was similar to that of previous studies on students from the same university (e.g., Moneta & Spada, 2009; Rogaten & Moneta, 2013, 2015).

A university ethics board approved the study. Participants were approached individually in common areas of the University. The study was described to participants as an investigation of the role of psychological factors in predicting study habits and academic performance. Following the granting of informed consent, participants were sent an email with the hyperlink to an online survey. Participants were debriefed online upon completion of the survey.

Measures

Overview

The online survey contained seven standardized questionnaires that have been widely used in educational research on university students. The instructions to participants differed between the scales measuring process variables and those measuring structure variables. The instructions for the questionnaires measuring process variables were: “[...] please respond thinking of your current experience and behavior when you engage in study activities [...]”. The instructions for the questionnaires measuring structure variables were “[...] please respond thinking of your general experience and behavior across situations and times when you study [...]”. After administering the online survey, each participants' academic performance was calculated based on the information retrieved from the university registry.

Academic performance.

Consistent with the university's assessment scheme, all students in the sample had their examinations at the end of a semester, and all coursework submissions took place in the second half of a semester. Students' grades (expressed in percentage points, with 40 % representing the minimum passing grade) were retrieved from the university registry for the current and previous semester. The individual examination grades and individual coursework grades were separately identified for each participant and a student's semester average was calculated separately for each of the two types of grades across all the courses taken in that semester ².

Process variables

Approaches and Study Skills Inventory for Students (ASSIST Short Version; Entwistle, 2008). The ASSIST Short version consists of 18 items measuring individual tendencies to adopt deep (e.g., "When I am reading an article or book, I try to find out for myself exactly what the author means"), strategic (e.g., "I organise my study time carefully to make the best use of it"), and surface (e.g., "I concentrate on learning just those bits of information I have to know to pass") approaches to studying, each using six dedicated items. The responses were recorded on a 4-point scale ranging from 1 (*Disagree*) to 4 (*Agree*). The scale has good internal consistency ranging from .80 to .87 and concurrent validity through positive correlations of deep and strategic approaches to studying, and a negative correlation of surface approach to studying, with self-reported academic performance (Tait, Entwistle, & McCune, 1998).

² The prior academic performance of first year undergraduate students was calculated on either the grades they obtained in their foundation degree (if they took part in this study during the first semester of the first year of their undergraduate degree) or the grades they obtained in the first semester of the first year of their undergraduate degree (if they took part in this study during the second semester of the first year of their undergraduate degree). Postgraduate students' grades were all gathered in the second semester of their postgraduate degree, and hence the grades from the first semester of their postgraduate degree were used to calculate their prior academic performance.

Positive and Negative Affect Schedule – Short Form (1-PANAS-SF; Thompson, 2007) consists of 10 adjectives measuring positive affect (e.g., “attentive”) and negative affect (e.g., “nervous”). The responses were recorded on a 5-point scale ranging from 1 (*None*) to 5 (*Very much*). The scale showed good internal consistency .80 (positive affect) and .74 (negative affect), good eight week test-retest reliability of .84 for both subscales, 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).

Use of Creative Cognition Scale (UCCS; Rogaten & Moneta, 2015a). The UCCS consists of five items measuring frequency of use of creative cognition in study-related activities (e.g., “I find effective solutions by combining multiple ideas”). The responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The scale has good internal consistency of .82 and concurrent validity through positive correlations with adaptive metacognitive traits, trait intrinsic motivation and positive affect, and good discriminant validity through lack of correlation with key maladaptive metacognitive traits (Rogaten & Moneta, 2015a).

Evaluation Anxiety Scale (EVAN; Thompson & Dinnel, 2001). The EVAN consists of 15 items measuring anxiety in evaluative situations (e.g., “I get anxious when I am given a homework assignment that challenges my ability to do well”). The responses were recorded on a 7-point scale ranging from 1 (*Not at all true of me*) to 7 (*Very true of me*). The scale has good internal consistency of .85 and good concurrent validity through positive correlations with fear of negative evaluation, test anxiety and fear of failure (Thompson & Dinnel, 2001).

Structure variables

Work Preference Inventory (WPI; Amabile et al., 1994). The WPI consists of 30 items, trait intrinsic (e.g., “I enjoy tackling problems that are completely new to me”) and extrinsic motivation (e.g., “I am concerned about how other people are going to react to my

ideas”), each using 15 dedicated items. The responses were recorded on a 4-point scale ranging from 1 (*Never or almost never true of you*) to 4 (*Always or almost always true of you*). The scores for trait intrinsic and extrinsic motivation were calculated by averaging the scores of their constituent items. The scale has satisfactory internal consistency of .70 for extrinsic motivation and .75 for intrinsic motivation, and has good concurrent validity through positive correlations with measures of personal development, autonomy, ability utilization and achievement (Loo, 2001).

Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ; Beer & Moneta, 2010). The PMCEQ consists of 18 items measuring three adaptive metacognitive traits, each using six dedicated items. For the purpose of this study only factors 2 and 3 were used in the analysis: (2) confidence in interpreting own emotions as cues, restraining from immediate reaction, and mind setting for problem solving (e.g., “I tend to rationally evaluate unpredictable situations rather than getting anxious”), and (3) confidence in setting flexible and feasible hierarchies of goals (e.g., “I find it fairly easy to identify important needs and goals for me”). The responses were recorded on a 4-point scale ranging from 1 (*Do not agree*) to 4 (*Agree very much*). The subscale scores were calculated by averaging the scores of their constituent items. The subscales have good internal consistency in the .80 to .88 range, and good convergent validity through positive correlations of PMCEQ-2 and PMCEQ-3 with trait intrinsic motivation (Beer & Moneta, 2010).

Meta-Cognitions Questionnaire 30 (MCQ-30, Wells & Cartwright-Hatton, 2004). The MCQ-30 consists of 30 items measuring five maladaptive metacognitive traits, each using six dedicated items. For the purpose of this study only the first four factors were used in the analysis: (1) positive beliefs about worry (e.g., “I need to worry in order to remain organised”), (2) negative beliefs about thoughts concerning uncontrollability and danger (e.g., “I cannot ignore my worrying thoughts”), (3) cognitive confidence (lack of, e.g., “I do not

trust my memory”), and (4) beliefs about the need to control thoughts (e.g., “I should be in control of my thoughts all the time”). The responses were recorded on a 4-point scale ranging from 1 (*Do not agree*) to 4 (*Agree very much*). The subscale scores were calculated by averaging the scores for their constituent items. The subscale scores have good internal consistency in the range .72 to .93, and good convergent validity through positive correlations with obsessive-compulsive symptoms, worry, and trait anxiety (Wells & Cartwright-Hatton, 2004).

Data analysis

The model was tested using structural equation modeling in LISREL 8.8 (Jöreskog & Sörbom, 1996). All variables in the model were defined as latent variables with congeneric indicators in order to control for measurement error. Prior semester academic performance and current semester academic performance were defined as two latent variables using the corresponding semester average examination grade and semester average coursework grade as indicators. Positive affect, negative affect and creative cognition were defined as latent variables using their constituent items as indicators. Adaptive metacognition was defined as a latent variable using the PMCEQ-2 and PMCEQ-3 subscales as indicators. Maladaptive metacognition was defined as a latent variable using the MCQ-30-1 through MCQ-30-4 subscales as indicators. Indicators for all other variables in the model (trait intrinsic motivation, trait extrinsic motivation, evaluation anxiety, deep, strategic and surface approaches to studying) were created using parceling, which were formed using the “item-to-construct” method (Little, Cunningham, Shahar, & Widaman, 2002).

The model includes 12 latent variables as predictors or mediators of academic performance. Although the sample size is generally sufficient to estimate the hypothesized model as a whole on the data of the present study, the test of indirect effects has low statistical power and is likely to be strongly biased by violations of the Normality assumption. The

problem of low statistical power was addressed by a prudent interpretation of nonsignificant findings. The problem of bias in estimation was addressed using a bootstrap estimation procedure, based on 10,000 samples drawn from the covariance matrix of the model, which provides robust estimates. In particular, the statistical significance of the indirect effects was evaluated based on percentile 90% confidence intervals calculated on the bootstrapped samples.

The chi-square test (Jöreskog & Sörbom, 1996) was used to assess the strict goodness of fit of the model. The model was then assessed for close fit using Hu and Bentler's (1999) criteria with the cut-off point of .95 for the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI), and of .05 for the Root Mean Square Error of Approximation (RMSEA).

Results

Data description

Table 1 shows the descriptive statistics, correlations, and internal consistency coefficients of the study variables. The study variables had from satisfactory to good internal consistency, with the exception of trait extrinsic motivation that just failed to reach the satisfactory level of .7. All hypothesized correlations were of the expected sign and significant, with the exception of the nonsignificant correlation between deep approach to studying and academic performance.

Insert Table 1 about here

Test of the model

The chi-square test for the hypothesized model was significant (chi-square = 1624.86, $df = 827$, $p < .001$), indicating that model does not fit strictly. However, the other indices reveal that the model fits closely (CFI = .96; NNFI = .95; RMSEA = .051, 90% CI = .047 –

.055). The model explained 90% of variance in academic performance, 46% in positive affect, 48% in negative affect, 53% in deep, 45% in strategic, and 54% in surface approaches to studying, 53% in use of creative cognition in studying, and 34% in evaluation anxiety.

Figure 2 shows the model with estimated standardized path coefficients. All the paths from approaches to studying to academic performance were non-significant, which does not support hypothesis 1. The path from positive affect to academic performance was positive and significant, whereas the path from negative affect to academic performance was nonsignificant; as such, hypothesis 2a is supported whereas hypothesis 2b is not. The paths from the use of creative cognition to positive affect, deep and strategic approaches to studying were all positive and significant, which supports hypothesis 3. The paths from evaluation anxiety to negative affect and surface approach to studying were all positive and significant, which supports hypothesis 4. The path from trait intrinsic motivation to deep approach to studying was positive and significant, whereas the path from trait extrinsic motivation to surface approach to studying was negative and significant; as such, hypothesis 5a is supported, whereas hypothesis 5b is disconfirmed. The paths from trait intrinsic motivation to use of creative cognition and from trait extrinsic motivation to evaluation anxiety were both positive and significant, which supports hypothesis 6. The paths from adaptive metacognition to positive affect and strategic approach to studying and the paths from maladaptive metacognition to negative affect and surface approach to studying were all positive and significant, which supports hypothesis 7 with the exception of hypothesis 7c stating a path from adaptive metacognition to deep approach to studying. Finally, the paths from adaptive metacognition to the use of creative cognition and the path maladaptive metacognition to evaluation anxiety were both positive and significant, which supports hypothesis 8. In all, hypotheses 2a, 3, 4, 5a, 6, 7a, 7b, 7d, 7e, and 8 are supported; hypotheses 1, 2b and 7c are not supported; hypothesis 5b is disconfirmed.

Of the 16 hypothesized intermediate paths, the findings fail to support only that from adaptive metacognition to deep approach to studying. Of the five hypothesized direct effects on academic performance, the findings support only that from positive affect to academic performance. As such, the key finding is that the only significant direct predictors of academic performance are past semester academic performance and positive affect in studying.

 Insert Figure 2 about here

Sensitivity analyses

Two sensitivity analyses were conducted. In the first, we examined the assumption that the structure variables (motivational orientations and metacognitions) and the first-level mediators (creative cognition and evaluation anxiety) do not have direct effects on academic performance. This was achieved by adding a direct path from each of these variables to academic performance, and comparing the expanded model to the hypothesized model by the difference of chi-square test. The difference in fit between the two models was not significant (Δ chi-square = 6.77, $df = 6$, $p < .343$). Moreover, the t tests of each of the added paths were nonsignificant (results not shown). These findings suggest that the direct effects of the trait variables and first-level mediators on academic performance are negligible.

In the second analysis, we examined the assumption that positive affect in studying originates from the actual experience of studying, rather than from the reinforcement provided by previously earned grades. This was achieved by adding a path from past academic performance to positive affect, and comparing the expanded model to the hypothesized model. The difference in fit between the two models was not significant (Δ chi-square = .22, $df = 1$, $p < .639$), and the standardized coefficient of the added path was weak (.01). This

finding suggests that the reinforcement process such that good past academic performance fosters positive affect is negligible, and hence that positive affect reflects mainly the positive emotions of studying.

Test of mediation

Table 2 shows the estimated indirect effects of the structure variables and first-level mediators on academic performance, and their bootstrapped percentile 90% confidence intervals. Four indirect effects were significant, and each was of the hypothesized direction.

With reference to the structure variables, both positive-adaptive traits had positive indirect effects on academic performance, whereas both negative-maladaptive traits had no indirect effects on academic performance. In particular, trait intrinsic motivation had a positive effect through the use of creative cognition (first-level mediator) and positive affect (second-level mediator) (path chain 1). Moreover, adaptive metacognition had a positive effect through the use of creative cognition (first-level mediator) and positive affect (second-level mediator) (path chain 4), and a less indirect positive effect through positive affect (path chain 7). As such, trait intrinsic motivation and adaptive metacognition are indirect predictors of academic performance, whereas trait extrinsic motivation and maladaptive metacognition are neither direct nor indirect predictors of academic performance.

Turning attention to the first-level mediators, creative cognition had a positive indirect effect on academic performance through positive affect (path chain 10), whereas evaluation anxiety had no indirect effects on academic performance. The finding on creative cognition suggests that the use of creative cognition fosters academic performance independently of a student's levels of trait intrinsic motivation and adaptive metacognition. The finding on evaluation anxiety closes the circle on the negative-maladaptive submodel, showing that no variable in that submodel predicts academic performance either directly or indirectly.

Insert Table 2 about here

Discussion

This study tested a model of end-of-semester academic performance, in which motivational orientations and metacognitions were the predictor variables, use of creative cognition and evaluation anxiety were the first-level mediator variables, affect and approaches to studying were the second-level mediator variables, and prior semester academic performance was the control variable. The model allowed to examine simultaneously the effect of adaptive-positive and maladaptive-negative structures and processes on students' academic performance, and to determine which of the two are overall more influential on students' academic performance. Five key findings from this study shed light on the psychological variables that most influence academic performance, and hence are candidates for future intervention studies.

Key findings

Positive affect as predictor

Positive affect in studying was the strongest and sole psychological and direct predictor of students' academic performance. This finding is consistent with prior empirical studies (e.g., Dosseville, Laborde, & Scelles, 2012; Rogaten et al., 2013) and various theories of emotions. Drawing from the mood-as-input theory (Martin et al., 1993), students who experience positive affect in studying are likely to interpret their emotions as a sign that the activity is enjoyable and hence are likely to devote more time and effort to studying. Drawing from the broaden-and-build model (Fredrickson, 1998, 2001), students who experience positive affect should accrue more psychological, physical, and social resources and, in turn, learn more and perform better academically. Finally, based on the control-process theory

(Carver & Scheier, 1990, 2001), positive affect in studying can be seen as a subjective judgment on one's own learning progress, in such a way that students who experience more positive affect in studying perceive themselves as learning faster than anticipated. In all, this study supports the crucial importance of positive affect to learning and academic performance, and is consistent with both the conjecture that positive affect fosters learning and the conjecture that positive affect signals that progress in learning is faster than anticipated.

Positive affect as mediator

Positive affect in studying mediated the positive effects of trait intrinsic motivation, adaptive metacognition, and use of creative cognition on academic performance. In particular, trait intrinsic motivation had a positive indirect effect on academic performance through the use of creative cognition (first-level mediator) and positive affect (second-level mediator). This finding is in line with Amabile and co-workers (1986) and Hennessey and co-workers (1989), who consistently found that intrinsic motivation – measured as either a state or trait – facilitates creative output, and with Amabile and co-workers (1996), who found that trait intrinsic motivation correlates with grades. Nevertheless, this finding goes beyond previous studies by showing that: (a) trait intrinsic motivation also enhances positive affect by fostering the use of creative cognition, and (b) the positive relation between trait intrinsic motivation and grades is entirely due to the mediating effects of use of creative cognition and positive affect, in that order. Moreover, adaptive metacognition had both a direct and indirect effect, through the use of creative cognition (first-level mediator), on positive affect (second-level mediator) and, in turn, academic performance. These findings are generally consistent with Antonietti and co-workers (2000) and Swanson (1990, 1992), who identified metacognition as an important contributor to creative problem solving, and suggest, in addition, that: (a) adaptive metacognition also enhances positive affect directly and indirectly,

by fostering the use of creative cognition, and (b) the positive relation between adaptive metacognition and grades is entirely due to the chained mediating effects of use of creative cognition and positive affect, in that order.

In all, students who are intrinsically interested in studying (trait intrinsic motivation) and have adaptable hierarchies of learning goals and a mind set for problem solving (adaptive metacognition) appear to be more likely to use divergent and convergent thinking, metaphorical and analogical thinking, perspective taking, or visualization strategies (use of creative cognition) when tackling academic problems and studying in general. In turn, students who use more creative cognition in studying would tend to experience more positive affect in studying and, in turn, perform better academically. As such, it is possible that positive affect in studying channels and converts positive structures and processes into better academic performance.

Use of creative cognition as predictor

Besides functioning as a first-level mediator, the use of creative cognition was the strongest stand-alone direct predictor of positive affect in studying and the strongest stand-alone indirect predictor (through the mediation of positive affect) of academic performance. These findings are consistent with Rogaten and Moneta (2015b), who found that use of creative cognition in a semester predicts positive affect in the following semester, and provide two extensions: (a) the effect of use of creative cognition on positive affect appears to pass on academic performance, and (b) the use of creative cognition appears to have an effect on academic performance irrespective of a student's levels of trait intrinsic motivation and adaptive metacognition. As such, the use of creative cognition is a crucial variable in the model, and an attractive intervention target even for students who stand low on trait intrinsic motivation and adaptive metacognition.

Uninfluential negative-maladaptive submodel

All the psychological variables that were hypothesized to undermine learning and hence academic performance did not predict academic performance. On the one hand, maladaptive metacognition and trait extrinsic motivation predicted evaluation anxiety, negative affect, and surface approach to studying, consistent with a wealth of empirical studies (e.g., Prat-Sala & Redford, 2010; Spada & Moneta, 2012, 2014). On the other hand, all the maladaptive-negative psychological variables included in the model failed to explain additional variance in academic performance to that explained by adaptive-positive psychological variables, consistent with a similar study that, however, considered a subset of the variables included in the present study (Rogaten et al., 2013). These findings suggest that adaptive-positive structures and processes are on the whole better predictors of academic performance than maladaptive-negative structures and processes. In all, academic performance seems to be influenced more by the presence of positivity than by the absence of negativity.

Independence of submodels

The correlations between the variables of the adaptive-positive and maladaptive-negative submodels were weak. This implies that, for example, if a student has low levels of trait extrinsic motivation, maladaptive metacognition, evaluation anxiety, negative affect, and surface approach to studying, no inference can be made on that student's levels of trait intrinsic motivation, adaptive metacognition, use of creative cognition, adaptive approaches to studying, and positive affect in studying. In all, the investigated adaptive-positive and maladaptive-negative structures and processes in learning seem quite independent of each other, and the adaptive-positive structures and processes are way more relevant to academic performance.

Potential applications

The weak relationship between adaptive-positive and maladaptive-negative structures and processes has an important implication for the design of educational interventions: intervening on trait extrinsic motivation, maladaptive metacognition, evaluation anxiety, negative affect, and surface approach to studying may improve students' experience but will not result in the increase of adaptive-positive structures and processes, and will not result in higher academic performance. As such, the most promising opportunity for improving students' academic performance is to intervene on adaptive-positive psychological predictors of academic performance.

Based on the found relationships between the use of creative cognition in studying, positive affect in studying, and academic performance, it seems that educational interventions aiming to foster students' academic success should be primarily directed at enhancing positive affect in studying. This can be achieved directly – e.g., through infusing enthusiasm in students, challenging students intellectually, and providing encouraging supervisory support – or indirectly, by intervening on variables that foster positive affect in studying. However, intervening directly on positive affect can be problematic, as sensitivity to emotion-eliciting stimuli is largely determined by temperament (Clark & Watson, 1999), notably extraversion (Gomez, Cooper, McOrmond, & Tatlow, 2004). It therefore is more viable to intervene on variables that foster positive affect, among which the use of creative cognition emerged as the target variable of choice in the present study. Given that every student can use creative cognition when coping with study problems, and can be encouraged and trained to do so, intervening on students' use of creative cognition in studying is the most promising strategy for interventions aimed at fostering positive affect in studying and, in turn, academic performance.

Although academic performance undoubtedly is an important target variable for any educational intervention, the emerging target variable in Higher Education is students' creative ability (e.g., Csikszentmihalyi, 2014; Dino, 2015; Moyer & Wallace, 1995). As such, both academic performance and its best predictor – positive affect – can also be viewed as instrumental to the overarching goal of fostering students' creative ability, as they provide intrinsic and extrinsic reinforcement to the use of creative cognition. Nevertheless, the use of creative cognition can and should also be targeted directly in order to foster development over and above “natural” development. In what follows, we propose four principles that should guide any such intervention.

First, students should be given creative tasks, that is, tasks for which creativity is both possible and desirable. Amabile (1982, 1996) proposed a distinction between “algorithmic” and “heuristic” tasks, which can help to identify creative tasks. A task is algorithmic if someone is given beforehand a complete set of steps for completing the task, and completing the task is only a question of carrying out the steps. Instead, if discovering the steps is part of the task itself, then the task is heuristic. In order to be creative a problem must be heuristic, that is, it should not have a clear and readily identifiable path to a solution. As such, the minimal condition is that students be given plenty of heuristic problems to practice with. Moreover, students should be confronted with hard, ill-conditioned heuristics problems, such as problems with no clear path to a solution, problems with multiple paths to a solution, problems with no solution at all, problems with unstated constraints, and problems to which no general rule applies (e.g., Sternberg, 2006). These are the kind of problems humanity is confronting on a daily basis, such as predicting financial crises, addressing global warming, or preventing war, and hence it should not be hard to explain to students why they are asked to tackle tough problems.

Second, when given creative tasks, students should be asked to work on them from beginning to end, completing all the phases of the creative process identified, for example, in Amabile's (1983, 1996) componential model of the creative process: task representation, preparation, response generation, response validation, and outcome evaluation. The practical wisdom of doing so is that ideas that are creative but not well formed and well presented are rarely recognized and rewarded, and are sometimes stolen by somebody who knows how to develop them into full-fledged and winning ideas. A few historical examples could easily convince students of the importance of developing and bringing to fruition their creative ideas.

Third, students should be given clear feedback on the contextual appropriateness of their creative attempts. As Kaufman and Beghetto (2013) humorously put it, whereas it is important to teach students to be creative, it is equally important to teach them when not to be creative. For example, it is not uncommon that a paragraph in an essay or report uses multiple terms to refer to the same concept or variable, creating unnecessary confusion in the reader. It is only by receiving appropriateness feedback that students can develop the metacognition of creativity and the ability to read the contextual cues that constrain the deployment of creativity.

Finally, building on the previous points, it is necessary to assess students' creative ability and their development in the course of their studies using performance-oriented methods in addition to standardized tests of divergent and convergent thinking. In this connection, the key assumption underlying the consensual definition and assessment technique of creativity (Amabile, 1982, 1996) is that although certain thinking processes – which can be measured using standardized creativity tests – and personality characteristics – which can be measured using standardized personality questionnaires – might be associated with creativity, they are not, themselves, creativity. Ultimately, it is in the fruit of those

thinking processes and personality dynamics, in the actual work produced by the individual, that creativity manifests itself. From this perspective, the most appropriate measure of students' creative ability is the level of creativity exhibited in their work – be it examination, coursework, or presentation – as evaluated by independent experts in the field who are blind in respect to students' identity. For this reason, creative ability and its development should also be measured using the consensual assessment technique on numerous, repeated samples of student work produced throughout the course of study.

Limitations and directions for future research

The findings of this study should be considered in the light of four key methodological limitations. First, this study is cross-sectional and hence cannot imply causation. Future research should test the hypothesized causal relationships using longitudinal study designs. Second, the sample size is relatively small given the complexity of the model, and hence the power of tests is limited. This implies that some of the relationships that were found nonsignificant in this study – such as those involving maladaptive-negative psychological variables as predictors or mediators of academic performance – may turn out to be significant in larger samples. As such, replications on larger samples are needed. Third, this study gathered data from a heterogeneous sample of students from various faculties, degree levels and ethnic backgrounds, which is an appropriate choice of sample for an initial testing of the model. However, future research should test the model on larger and more homogeneous student samples to see if the found relationships hold, in particular, for different degree subjects and different degree levels. This is because the relationships between the variables in the model may be influenced by seniority, as students tend to focus more on their academic performance toward the end of their degree, and age, as mature age students tend to take their studies more seriously from the start. Finally, the classification of psychological variables as either structures or processes was based on theory and previous use of the measurement

scales. The cross-sectional study design prevented modeling stability over time, and both structures and processes were measured using self-reports. Therefore, future studies should test whether the hypothesized structure variables are in fact more stable than the hypothesized process variables.

Conclusion

Despite its limitations, the present study advances our understanding of the relationship between psychological variables and academic performance in university students. The model explained nearly all the variance in academic performance, with prior academic performance and positive affect in studying being the only direct predictors. The use of creative cognition in studying mediated the positive effects of trait intrinsic motivation and adaptive metacognition on positive affect in studying and, in turn, academic performance. The variables thought to have an undermining effect on learning failed to predict academic performance. In sum, this study suggests that any intervention designed to improve students' academic performance should concentrate on developing their adaptive-positive study behaviors, in particular the use of creative cognition in tackling study problems.

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Table 1.

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

Variable	X	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
1. Ex	58.01	15.32	(-)																		
2. Cw	61.58	11.10	.615**	(-)																	
3. Past Ex	59.20	15.11	.640**	.524**	(-)																
4. Past Cw	62.12	11.23	.587**	.552**	.602**	(-)															
5. Deep	3.00	0.55	.036	.051	.031	.035	(.76)														
6. Strategic	2.97	0.64	.226**	.193**	.225**	.235**	.509**	(.81)													
7. Surface	2.31	0.61	-.243**	-.229**	-.205**	-.181**	-.145**	-.384**	(.72)												
8. PA	3.64	0.76	.142**	.178**	.076	.121**	.441**	.608**	-.365**	(.8)											
9. NA	2.10	0.82	-.159**	-.135**	-.114*	-.105*	-.090*	-.213**	.45**	-.099*	(.8)										
10. UCCS	3.66	0.71	.118*	.216**	.098*	.141**	.549**	.473**	-.206**	.484**	-.113*	(.83)									
11. EVAN	4.10	1.03	-.134**	-.109*	-.145**	-.061	-.205**	-.25**	.518**	-.200**	.458**	-.230**	(.83)								
12. IM	2.88	0.45	.096*	.161**	.100*	.132**	.491**	.378**	-.297**	.450**	-.154**	-.287**	.568**	(.81)							
13. EM	2.65	0.40	.094*	.175**	.104*	.156**	.128**	.14**	.075	.169**	.143**	.292**	.162**	.113*	(.68)						
14. AM 2	2.48	0.65	.063	.121**	.093*	.080	.276**	.352**	-.346**	.330**	-.277**	-.414**	.416**	.423**	-.085	(.79)					
15. AM 3	2.70	0.67	.171**	.192**	.201**	.158**	.273**	.452**	-.385**	.432**	-.293**	-.336**	.465**	.432**	.038	.705**	(.85)				
16. MM 1	2.02	0.75	.031	.048	-.008	.021	.067	.006	.147**	.073	.195**	.142**	.083	.078	.196**	.053	.108*	(.89)			
17. MM 2	2.12	0.79	-.073	-.061	.051	-.057	-.011	-.148**	.365**	-.131**	.499**	.372**	-.060	-.106*	.163**	-.280**	-.270**	.313**	(.85)		
18. MM 3	1.90	0.69	-.085*	-.060	-.060	-.043	-.100*	-.265**	.381**	-.224**	.306**	.353**	-.087*	-.135**	.081	-.221**	-.228**	.216**	.500**	(.83)	
19. MM 4	2.04	0.66	-.126**	-.058	-.167**	-.083	.051	-.064	.153**	-.047	.229**	.140**	.088*	.067	.234**	.072	.012	.313**	.441**	.386**	(.73)

Notes. $n = 373$; “-“ means that the corresponding statistic cannot be estimated; Ex – semester examination Grade Point Average; Cw – semester coursework Grade Point Average; Past Ex – past semester examination Grade Point Average; Past Cw – past semester coursework Grade Point Average; Deep – deep approach to studying; Strategic – strategic approach to studying; Surface – surface approach to studying; PA – positive affect; NA – negative affect; EVAN – evaluation anxiety; UCCS – use of creative cognition scale; IM – intrinsic motivation; EM – extrinsic motivation; AM – adaptive metacognition; MM – maladaptive metacognition.

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

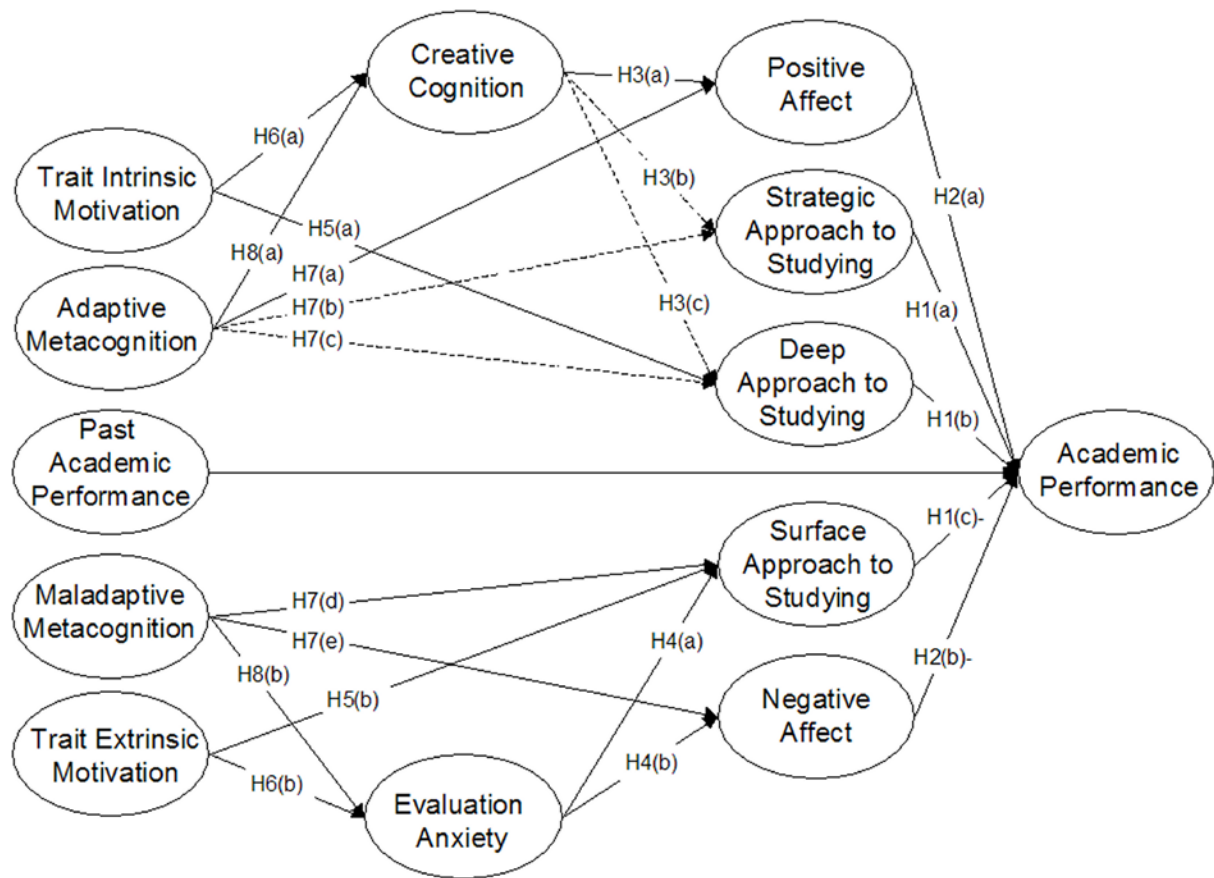
Table 2.*Estimated indirect effects on academic performance and their bootstrapped percentile 90% confidence intervals.*

	Path Chain	Estimate	Percentile 90% CI
1.	Trait Intrinsic Motivation → Creative Cognition → Positive Affect → Academic Performance	.029*	.020 – .197
2.	Trait Intrinsic Motivation → Creative Cognition → Deep Approach to Studying → Academic Performance	-.001	-.224 – .187
3.	Trait Intrinsic Motivation → Deep Approach to Studying → Academic Performance	-.001	-.201 – .152
4.	Adaptive Metacognition → Creative Cognition → Positive Affect → Academic Performance	.014*	.009 – .095
5.	Adaptive Metacognition → Creative Cognition → Strategic Approach to Studying → Academic Performance	-.008	-.073 – .052
6.	Adaptive Metacognition → Creative Cognition → Deep Approach to Studying → Academic Performance	-.001	-.116 – .088
7.	Adaptive Metacognition → Positive Affect → Academic Performance	.032*	.021 – .236
8.	Adaptive Metacognition → Strategic Approach to Studying → Academic Performance	-.026	-.226 – .153
9.	Adaptive Metacognition → Deep Approach to Studying → Academic Performance	.000	-.178 – .215
10.	Creative Cognition → Positive Affect → Academic Performance	.052*	.038 – .358
11.	Creative Cognition → Strategic Approach to Studying → Academic Performance	-.030	-.271 – .186
12.	Creative Cognition → Deep Approach to Studying → Academic Performance	-.003	-.412 – .342
13.	Maladaptive Metacognition → Surface Approach to Studying → Academic Performance	-.025	-.319 – .102
14.	Maladaptive Metacognition → Negative Affect → Academic Performance	-.019	-.397 – .149
15.	Maladaptive Metacognition → Evaluation Anxiety → Negative Affect → Academic Performance	-.006	-.130 – .048
16.	Trait Extrinsic Motivation → Surface Approach to Studying → Academic Performance	.009	-.069 – .219
17.	Trait Extrinsic Motivation → Evaluation Anxiety → Negative Affect → Academic Performance	-.002	-.073 – .027
18.	Trait Extrinsic Motivation → Evaluation Anxiety → Surface Approach to Studying → Academic Performance	-.006	-.103 – .030
19.	Evaluation Anxiety → Surface Approach to Studying → Academic Performance	-.032	-.394 – .109
20.	Evaluation Anxiety → Negative Affect → Academic Performance	-.013	-.268 – .096

* $p < .05$ (Normal test, 1-tailed)

Figure 1.

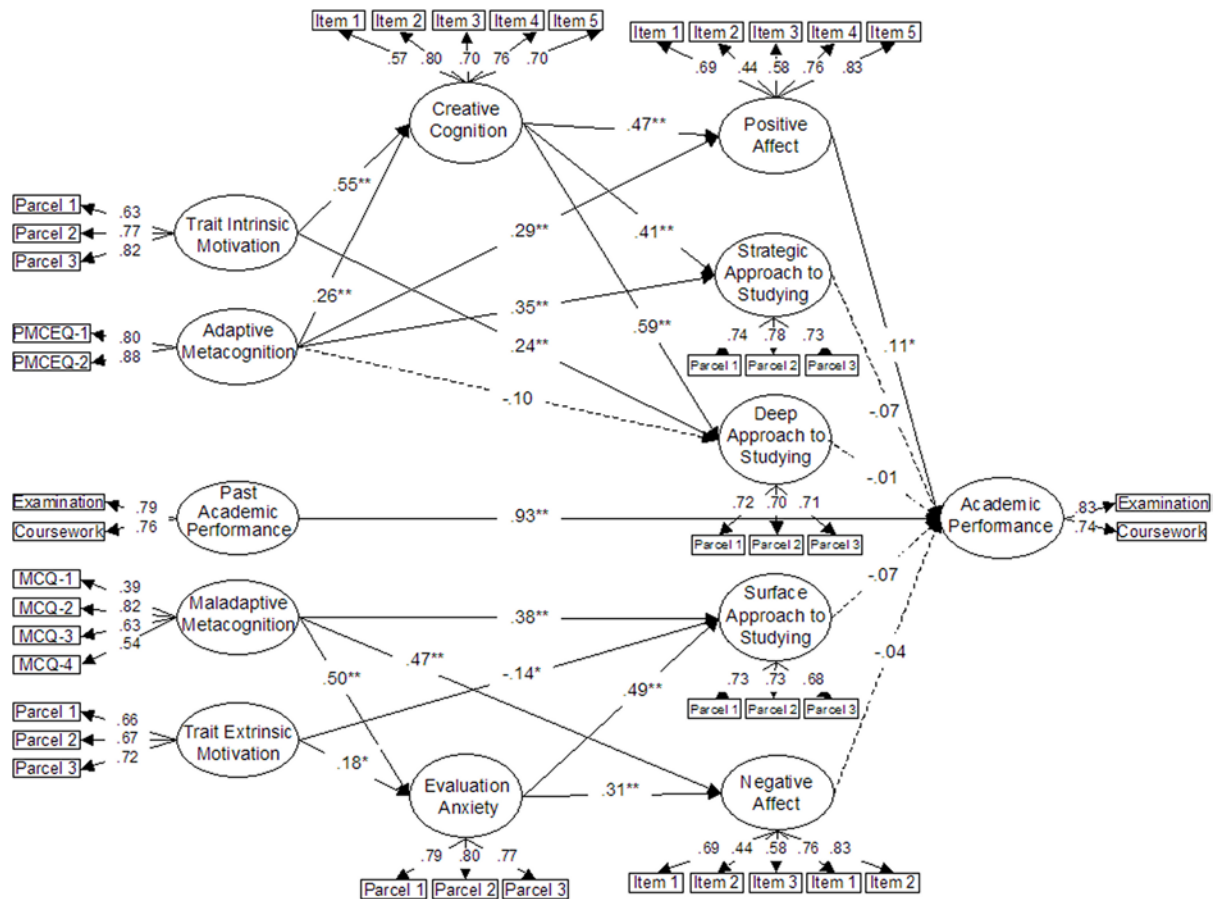
The hypothesized chained mediation model of academic performance.



Notes. "-" indicates a negative association. Continuous lines represent paths that have received some empirical support in prior studies, whereas dotted lines represent paths that were tested for the first time in this study.

Figure 2.

The estimated chained mediation model of academic performance with prior academic performance and positive affect in studying being the only significant direct predictors of current semester academic performance.



Notes. $n = 373$.

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