Adaptive-Positive vs. Maladaptive-Negative Structures and Processes in Learning: Towards the Comprehensive Model of Academic Performance

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ABSTRACT

The goal of this Ph.D. research was to develop an empirical foundation suitable for designing educational interventions and programmes aiming to improve students' learning. In order to achieve this, a series of studies was conducted that supported the development and test of a comprehensive, chained mediation model of academic performance. The proposed chained mediation model comprised of adaptive-positive and maladaptive-negative submodels. The adaptive-positive submodel hypothesised firstly that trait intrinsic motivation and adaptive metacognition would facilitate the use of creative cognition in studying (first-level mediator). Secondly, the model hypothesised that the use of creative cognition in studying would lead to the experience of positive affect in studying, and to the development of adaptive approaches to studying (second-level mediators). Finally, the submodel hypothesised that positive affect in studying and adaptive approaches to studying would facilitate academic performance. The maladaptive-negative submodel hypothesised firstly that trait extrinsic motivation and maladaptive metacognition would lead to evaluation anxiety (first-level mediator). Secondly, the model hypothesised that evaluation anxiety would lead to the experience of negative affect in studying, and to the development of a maladaptive approach to studying (second-level mediators). Finally, the submodel hypothesised that negative affect in studying and the maladaptive approach to studying would undermine academic performance.

A total of five studies were conducted employing 2140 university students. Study 1 tested the effects of approaches to studying and positive and negative affect in studying on students' academic performance. The results strongly indicated that positive and negative affect in studying explains students' academic performance better than approaches to studying. Studies 2 and 3 developed and validated a new Use of Creative Cognition Scale (UCCS), which measures students' tendency to deploy creative thinking strategies in studying. Study 4 tested longitudinal relationship between positive affect in studying and the use of creative cognition. The results supported the reciprocal, longitudinal relationship between the two constructs. Finally, Study 5 proposed and tested the comprehensive, chained mediation model of academic performance. Structural equation modelling (SEM) showed that the model explained 90% of the variance in students' academic performance, and that prior academic performance and positive affect in studying were the only significant correlates. The use of creative cognition in studying was the strongest correlate of positive affect in studying, and also mediated the effect of trait intrinsic motivation and adaptive metacognition on positive affect. Overall, adaptive-positive psychological variables were superior to maladaptive-negative ones in explaining students' academic performance. Therefore, educational interventions aiming to enhance students' learning should target particularly adaptive-positive psychological variables in students. The possible model-based intervention is outlined.

ACKNOWLEDGMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF Ph.D. RELATED PUBLICATIONS

Study 1:

Rogaten, J., Moneta, G. B., & Spada, M. M. (2013). Academic

performance as a function of approaches to studying and affect in

studying. *Journal of Happiness Studies*, *14*(6), 1751–1763.

Study 2 and Study 3:

Rogaten, J., & Moneta, G. B. (in press). Development and validation of

the short Use of Creative Cognition Scale in studying.

Educational Psychology.

Study 4:

Rogaten, J., & Moneta, G. B. (submitted). Use of creative cognition and

positive affect in studying: Evidence of a reciprocal relationship.

Creativity Research Journal.

Study 5:

Rogaten, J., & Moneta, G. B. (in preparation). Boosting students'

academic performance: Conceptual chained, mediation model of

academic performance in Higher Education.

PREMISE

Currently universities across the UK invest a vast amount of resources into improving students' learning in Higher Education. Most existing schemes are mainly concerned with the development of academic skills and competences and there is an absence of programmes that intervene on psychological variables important for learning. One of the reasons for this is a lack of comprehensive models of learning that can be used as frameworks for designing interventions. This is due to a deficiency of research simultaneously looking at the effect of psychological variables that both undermine and facilitate learning. The main goal of this research is to evaluate what psychological variables affect learning and how they can be intervened on through developing and testing a comprehensive, chained mediation model of academic performance.

Students' academic performance was chosen as a measure of learning progress because firstly, it is universally recognised as the most appropriate measure of learning. Secondly, it is free from self-reported biases. Thirdly, using academic performance allows a direct comparison of research finding with the results of other studies. Finally, standardised assessments' results allow direct comparison between students (e.g., Anaya, 1999; Bowman, 2010; Gonyea, 2005).

Importantly, educational literature univocally advocates that prior academic performance is the strongest correlate of future academic performance (e.g., Diseth, 2007; Duff, 2004; Zeegers, 2004). Therefore, the effect of psychological variables on learning and academic performance has to be tested controlling for the effect of prior academic performance. This Ph.D. research aims to do just that by testing the comprehensive, chained mediation model of academic performance controlling for the compatible academic performance. The model will form an empirical foundation for prospective programmes and will enable identification of the best "candidate variables" for an intervention.

CHAPTER 1 – LITERATURE REVIEW

Primary Psychological Factors Contributing to Students'

Academic Performance in Higher Education

The aim of this chapter is to present a concise literature review of psychological variables affecting students' learning and academic performance. The main objective is to identify gaps in current research and knowledge and outline the theoretical frameworks for the following five studies. There are three main sections in this review, the first section introduces the students approaches to learning theory and examines the relationship between approaches to learning and academic performance. The second section reviews theories of emotions and examines their applicability to education. It also evaluates empirical evidence for the relationship between emotions and academic performance. The third section introduces the concept of creativity, in particular creative cognition, and reviews its relationship with academic performance.

1.1   Students' Approaches to Learning

The students' approaches to learning theory is based on Marton's and Säljö's (1976 a, b) two-factor model of levels of processing. Marton and Säljö grounded their two-factor model in

Craik's and Lockhart's (1972) account of memory formation. Craik and Lockhart (1972) argued that memory is a hierarchical system, which relies on two distinct levels of processing: the shallow and the deep. The shallow processing is an early and superficial form of analysing information, which results in a poor retention rate. The deep processing in contrast involves more abstract form of analysing information, which results in a better retention of material.

Marton and Säljö elaborated on this idea and contextualised it to education. They proposed that students' intentions to either understand or rote-learn new material will inform whether they will use the shallow or the deep processing i.e., engage in the surface or the deep learning. Despite the close resemblance of the two theories, Marton and Säljö argued that their account of a two-factor model of information processing is just a metaphorical resemblance of Craik's and Lockhart's (1972) account of memory formation (Marton & Säljö, 1984).

To test their two-factor model, Marton and Säljö (1976a) conducted a naturalistic experiment followed by interviews. During that experiment students read an academic article, knowing that in the end they will be assessed on what they have learned from the article. The interview took place straight after the experiment, but instead of asking students what they have learned, researches asked them how they learned new information.

The results revealed that […] basically two different *levels of processing* to be clearly distinguishable. These two different levels of processing, which we shall call *deep-level* and *surface-level processing*, correspond to the different aspects of the learning material on which the learner focuses. In the case of *surface-level processing* the student directs his attention towards learning the context itself *(the sign)*, i.e., he has a 'reproductive' conception of learning which means that he is more or less forced to keep to a rote-learning strategy. In case of *deep-level processing*, on the other hand, the student is directed towards the intentional content of the learning material *(what is signified)*, i.e., he is directed towards comprehending what the author wants to say about, for instance, a certain scientific problem or principle (Marton & Säljö, 1976 a, pp. 7-8).

In summary, students who did not reach a deep understanding of the article were not concerned with understanding. They were simply memorising facts that were likely to be assessed at the end of the experiment. However, some interview responses were classified as indicating "not clear" level of processing i.e., students did not display a clear preference for either deep- or surface-levels.

Marton and Säljö (1976b) also examined whether the mode of questioning had an effect on individuals' levels of processing. In this experiment students were randomly allocated to two different conditions and asked to read three academic texts. For the first two

texts students were assessed either on understanding (the deep condition) or on factual recall (the surface condition). For the third text everyone was assessed on understanding.

The authors discovered that students initially classified as deep learners, but who were allocated to the surface learning group, were able to adapt to the task requirements and shift from deep-level of processing to surface-level. However, students who were initially classified as surface learners, but were allocated to a deep learning condition found it much harder to adapt. They displayed what the authors called the "deep technified" approach. The "deep technified" approach was characterised by the students' ability to adequately summarise and report main ideas from the text, but they lacked detailed understanding of the material.

Research also examined whether students used the same levels of processing in experimental settings and in "real life". Svensson (1977) found that the majority of students – 23 out of 30 – were consistent in their levels of processing across two conditions. Furthermore, he observed a strong link between levels of processing and academic performance. Thus, nine out of ten students classified as deep learners, and only three out of thirteen students classified as surface learners passed all their exams.

The research by Marton and Säljö (1976 a, b) and Svensson (1977) used a qualitative approach to investigating students' levels of processing, which presented a few limitations. These included a small sample size, a poor ecological validity, and a lengthy procedure for

data collection and analysis. In order to address these limitations a self-reported questionnaire measuring students deep and surface learning was developed (Entwistle, Hanley, & Ratcliffe, 1979). Additionally, deep and surface levels of processing were perceived as rather narrow terms for defining the observed phenomenon i.e., they failed to adequately capture the effect of the environment on learning. As such, deep- and surface-levels of processing were renamed into deep and surface approaches to studying (Entwistle, Hanley, & Hounsell, 1979).

The results of quantitative research indicated that the original two-factor model of approaches to studying was a four-factor model separating deep and surface approaches to studying into "active" and "passive" (Entwistle, Hanley, & Ratcliffe, 1979). However, further research identified that the four-factor model should be replaced with a three-factor model (Entwistle, Hanley, & Hounsell, 1979). The three-factor model of approaches to studying is usually referred to as the Students Approaches to Learning (SAL) theory. In addition to deep and surface levels of processing, the three-factor model accounted for elements of achievement motivation i.e., "hope for success" (Atkinson & Raynor, 1974) and "fear of failure" (Entwistle & Wilson, 1977). It also encompassed Pask's (1976) theory of serialist

and holistic approaches to learning[1] (Entwistle, Hanley & Ratcliffe, 1979), and attitudes towards assessments (Miller & Parlett, 1974). Attitudes towards assessments referred to two types of behaviour: seeking cues about assessments or thinking of assessments as objective ways of testing knowledge. The three factors in the model corresponded to deep, surface and strategic approaches to studying.

The deep approach to studying was characterised by the deep interpretation and analysis of new information that students find interesting and of some personal meaning.

The decision to adopt a deep approach in a specific instance, however, will depend on being interested in the subject matter and having the necessary prior knowledge to be able to make sense of the study material. But actually reaching a deep understanding also depends on the amount and quality of the effort put into learning (Entwistle, 2008, p. 10).

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[1] Pask's (1976) theory of serialist and holistic approaches to learning postulates that students employing serialist approach (known as improvidence students) mainly concentrate on one concept at a time and critically consider the evidence for that concept, whereas students employing holistic approach (known as globetrotting students) mainly concentrate on the relationships between the concepts and aim for a comprehensive understanding. Pask (1976) also argued that the most adaptable strategy for learning is use of both serialist and holistic approaches (known as versatile students) as use of a sole approach may result in the development of learning pathologies.

Deep learners also showed a preference for using combination of holistic and serialist styles of learning i.e., seeing a topic as a whole or develop understanding step-by-step (Entwistle, 2008) and took greater responsibility for their learning (Vermunt, 1998).

The surface approach to studying was characterised by rote-learning and the fear of failure. Students adopting the surface approach to studying relied on memorising study material that was likely to be assessed at the examination. The surface learners were not concerned with in-depth understanding and were usually learning the minimum amount required for a pass (Entwistle & Peterson, 2004).

The strategic approach to studying – also referred to as achieving – was characterised by the students' target-oriented attitude toward learning. Achieving the best possible results on assessments motivated strategic learners. They had the tendency to seek understanding of the "assessments game" and were highly organised i.e., know assessments requirements, grading criteria and the teacher's expectations. Based on the assessments requirements, strategic learners would determine which approach to studying was the most likely to bring them closer to the highest grade/reward (Entwistle & Peterson, 2004; Ramsden, 1979).

1.1.2   Measures of approaches to studying

There are two main methods for assessing/measuring students' approaches to learning. The first method uses bottom-up qualitative approach and the main research technique is phenomenography

(Marton, 1986). Marton (1986) described phenomenography as being "more interested in the content of thinking […] *tries* to uncover all the understandings people have of specific phenomena and sort them into conceptual categories" (p. 32). Phenomenography is concerned with various conceptions of phenomena regardless of its correctness or incorrectness. It aims "to describe relations between the individual and various aspects of the world around them, regardless of whether those relationships are manifested in the forms of immediate experience, conceptual thought, or physical behaviour" (p. 42). Phenomenography largely measures approaches to learning as a product of environment and cognitive processing.

The second method uses top-down quantitative approach and the main research techniques are self-reported questionnaires. The most often used questionnaires are the ones developed by Entwistle and colleagues in UK and by Biggs and colleagues in Australia.

Approaches to Studying Inventory (ASI; Ramsden & Entwistle, 1981) was the first inventory designed to measure individual differences in study behaviour. It evolved from *Student Attitude Questionnaire (SAQ*; Entwistle & Wilson, 1970; 1977) and measured students' study orientations (meaning, reproduction and achieving) along with study styles and pathologies. The original questionnaire comprised of 64 items and 16 subscales. However, researchers using ASI inventory failed to replicate its factor structure (e.g., Clarke, 1986; Entwistle & Ramsden, 1983; Watkins & Hattie, 1985). As a result, shorter versions of ASI were proposed i.e., 30- items

(Entwistle, 1981), 18- items (Gibbs, Habeshaw, & Habeshaw, 1988), and 32- items (Richardson, 1990). The first two versions (30- and 18-item) were based on choosing fewer items to represent the main constructs/subscales, whereas the third version (32-item) of the inventory only included robust subscales. Research found that overall the meaning orientation and the reproduction orientation subscales were the most robust and reliable, whereas the achieving orientation subscale was unstable and lacked predictive validity. This was a common shortcoming across all ASI versions.

Revised Approaches to Studying Inventory (RASI; Entwistle & Tait, 1994; Tait & Entwistle, 1996) was developed following criticism of ASI's psychometric properties. In its essence, RASI was the revised version of ASI. It had reduced number of questions and the subscales were renamed to better reflect the measured construct. Thus, subscales of the meaning orientation, the reproduction orientation and the achieving orientation were renamed into deep, surface and strategic approaches to studying respectively. The RASI scale comprised of 38-items and 14 subscales, and it measured five constructs: deep, strategic and surface approaches to studying, lack of direction, and academic self-confidence. In general, RASI displayed a satisfactory reliability and factor stability. However, RASI was still poor at explaining students' academic performance and as such, the inventory needed further improvements (Waugh, 1999; Waugh & Addison, 1998).

Approaches and Study Skills Inventory for Students (ASSIST; Entwistle, Tait, & McCune, 2000; Tait & Entwistle, 1996; Tait, Entwistle, & MCcune, 1998) was designed to overcome ASI's and RASI's lack of predictive validity. The ASSIST comprised of 13 subscales measuring three main constructs: deep, surface and strategic approaches to studying. Reliability of ASSIST ranged from .80 to .87 (Tait & Entwistle, 1996) and it was better than ASI's and RASI's. Predictive validity of the ASSIST was also better. Thus, the deep approach positively correlated with self-reported academic performance and the strategic approach positively correlated with self-reported and actual academic performance. The surface approach, as expected, negatively correlated with both self-reported and actual academic performance. Conclusively, ASSIST was superior to ASI and RASI in measuring approaches to studying and had better predictive validity.

Study Process Questionnaire (SPQ; Biggs, 1978) was designed to assess the effect of study processes (values, motives and strategies) on the relationship between personality and institutional factors, and performance/outcomes. The SPQ derived from its precursor *Study Behaviour Questionnaire (SBQ*; Biggs, 1970). The original SPQ scale comprised of 10 subscales and 80 items. It measured students' study processes, motivation, personality and study skills. Further scale development led to the item reduction and the final SPQ scale only retained 42 items. The final version of a scale measured study processes along six subscales: deep motive and

strategy, surface motive and strategy, and achieving motive and strategy (Biggs, 1987). Biggs (1987) argued that motive and strategy were interdependent constructs. Thus, for successful learning students need motivation to get good grades as well as know the effective study strategies i.e., "know how". The terminology used in SPQ was adopted from Marton and Säljö (1976 a, b) research to highlight the similarity between Biggs' and Marton's and Säljö's ideas.

Two-Factor Study Process Questionnaire (R-SPQ-2F; Biggs, Kember, & Leung, 2001) was the revised version of the SPQ scale. R-SPQ-2F consisted of 20-items and measured only deep and surface learning strategies and motives. Achieving strategies and motives were removed from the new scale due to the poor factor loadings in SPQ. Thus, the achieving approach motives and strategies loaded on both, the deep approach (Biggs, 1987) and the surface approach (Biggs & Kirby, 1983) factors. Additionally, Biggs, Kember and Leung (2001) argued that the achieving approach conceptually described students' organisation of their study time and resources, whereas deep and surface approaches conceptually described the way students engage with learning material. As such, they argued that achieving approach should be removed from the scale. Most of the items in the new R-SPQ-2F scale were selected from the original SPQ. However, the surface approach subscale's reliability was less satisfactory in R-SPQ-2F ($a = .64$), than it was in SPQ.

Inventories developed by Entwistle and colleagues and Biggs and colleagues were structurally different, but all were designed to

measure the same construct (approaches to studying). Presently, it is impossible to determine to which extent the reviewed scales converge and whether they measure same or somewhat different constructs. Nevertheless, from little evidence available it is possible to conclude that the reviewed scales measure somewhat different constructs: ASI and SPQ scales correlated only moderately with each other (correlation coefficients ranging from .45 to .62; Wilson, Smart, & Watson, 1996). Therefore, taking into an account the limitations of each scale and differences between reviewed scales, the review of the relationship between approaches to studying and academic performance is presented separately for each measure of approaches to studying.

1.1.3 Approaches to Studying Inventory (ASI) and academic performance

The majority of the research using the ASI scale found a positive relationship between the deep approach to studying and students' academic performance and a negative relationship between the surface approach to studying and students' academic performance. Students' academic performance was generally measured as a semester or year examination scores and GPA. The summary of these studies is presented in Table 1.

Table 1: *Summary of Studies Examining the Relationship Between Approaches to Studying Measured by ASI and Students' Academic Performance in Higher Education.*

Reference	Sample	AP	Analysis	**Approaches to Studying Inventory (ASI)** Cross-sectional studies Correlation coefficient			Conclusion
				Deep	*Strat*	*Surf*	
(Clarke, 1986)	153 medical undergraduates	End-of-year assessment	Correlation	.38*	.46***	-.40*	Meaning (3rd year students) and achieving (1st and 3rd year students) orientations positively correlated with AP, whereas the reproduction orientation negatively correlated with AP (5th year students).
(Trigwell & Prosser, 1991)	122 - 1st year nursing communication course students	*Current*: quantity and quality of learning outcomes. *Prior*: 10 unit best marks	Correlation	.06	-	-.02	The meaning orientation positively correlated with learning outcomes quality, whereas the reproduction orientation did not correlate with either learning outcomes quality or quantity. Prior AP related to learning outcomes quantity.
(Newstead, 1992)	188 psychology undergraduates	End-of-year examination	Correlation	.22*	.19	-.07	Only meaning (overall sample) and achieving (3rd year students) orientations positively correlated with AP.
(Newstead, 1992)	188 psychology undergraduate students	End-of-year examination	Correlation	.22*	.19	-.07	Only meaning (overall sample) and achieving (3rd year students) orientations positively correlated with AP.

Table 1: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Richardson, 1995)	98 1st year research methods students	Undergraduate degree class	Correlation and partial correlation	-.06	-	.04	Learning orientations did not correlate with AP.
(Stiernborg, Guy, & Tinker, 1997)	316 nursing undergraduates	Graded Performance Index for each year	Correlation	.16*	.13	-.15*	The meaning orientation positively correlated, whereas the reproduction orientation negatively correlated with AP. The achieving orientation did not correlate with AP.
(Provost & Bond, 1997)	175 2nd year psychology students	Current: Module GPA Prior: 1st year GPA	Correlation	.01	-	-.16*	The meaning orientation did not correlate with AP, whereas the reproduction orientation negatively correlated with essay component of the assessment and overall AP.
(Lizzio, Wilson, & Simons, 2002)	249 commerce, 210 humanities and 187 science students	Overall degree GPA	Correlation, and SEM	.09	-	.18	Meaning and reproduction orientations positively correlated with AP, however only the reproduction orientation explained AP. Prior AP was significant but weak correlate of following AP.
(Trigwell, Ashwin, & Millan, 2012)	772 undergraduate students	Undergraduate degree class	Correlation and SEM	.17**	-	-.23**	The meaning orientation positively correlated, whereas the reproduction orientation negatively correlated and explained lower undergraduate degree class.

"-" Correlation coefficient was not reported; AP – academic performance.

Clarke (1986) and Newstead (1992) overall found that the deep approach to studying correlated stronger with students' higher academic performance in later years of a degree, whereas the surface approach to studying started to undermine academic performance. This pattern in the relationship between approaches to studying and academic performance can be attributed to the change in educational environment throughout the degree. The two main changes are the increase in complexity of the study material, and shift in assessments from assessing knowledge to assessing understanding (Watkins & Hattie, 1983). Therefore, they conjointly lead to a stronger positive relationship between the deep approach to studying and academic performance, and a stronger negative relationship between the surface approach and academic performance.

Despite the similarity in findings between deep and surface approaches to studying, and academic performance, Clarke (1986) and Newstead (1992) obtained dissimilar results for the relationship between the strategic approach to studying and academic performance. Thus, Clarke (1986) found that strategic approach positively correlated with academic performance in the beginning of a degree, whereas Newstead (1992) found that strategic approach positively correlated with academic performance in the end of a degree (Newstead, 1992). As such, these results suggest that students find the strategic approach to studying appropriate for maximising their grades in both beginning and end of a degree.

A rather unusual measure of academic performance was used by Richardson (1995) and Trigwell, Ashwin and Millan (2012). They examined the relationship between approaches to studying and the final degree class. The important difference between these two studies was the time lag between administration of the ASI questionnaire and assessment of academic performance. Richardson's (1995) study had 3.5 years time lag, whereas Trigwell's, Ashwin's and Millan's (2012) study had only 18 month time lag.

As a result, Richardson (1995) failed to find the relationship between approaches to studying and academic performance, whereas Trigwell's, Ashwin's and Millan's (2012) found that the deep approach positively correlated and the surface approach negatively correlated with academic performance. The absence of the relationship in the first study, but not in the second one indicates that students' approaches to studying can change with time. In some why the results of these two studies support Clarke's (1986) and Newstead's (1992) findings.

In contrast to other studies Richardson (1995) examined the effect of approaches to studying on academic performance statistically controlling for the effect of prior academic performance. He found that prior school GCE Advanced Levels explained final undergraduate degree class over and above approaches to studying.

However, the results of Richardson's (1995) and Trigwell's, Ashwin's and Millan's (2012) studies should be viewed in light of one key

limitation. Both studies coded students' academic performance as an ordinal variable (i.e., the class of the degree). This classification levelled out possible differences between students who got average grade of 69 and average grade of 60 (i.e., 2:1/B). As such, elimination of the difference between upper and lower performance in each degree class weakened the relationship between approaches to studying and academic performance.

Furthermore, both studies gave limited information about the types of assessments used throughout students' degree. Trigwell, Ashwin and Millan (2012) only mentioned that assessments practice within the university promoted the development of the deep approach to learning, whereas Richardson (1995) omitted the description of the educational environment altogether.

A somewhat different study, was carried out by Lizzio, Wilson and Simons (2002). Their aim was to examine whether approaches to studying could explain students' university GPA grades when controlling for tertiary entrance (TE) scores. They found that overall both deep and surface approaches to studying explained higher GPA. However, their study had flaws in design. Pre-university and university academic performance were calculated based on the assessments taken prior to the administration of the ASI scale. As such, testing a model where approaches to studying explain academic performance was inappropriate using their data. The only meaningful model the authors could test was

where students' tertiary entrance (TE) score explained university average GPA, which in its turn explained approaches to studying.

1.1.4 Revised Approaches to Studying Inventory (RASI) and academic performance

The majority of the research using the RASI scale found inconsistency and a general lack of the meaningful relationship between approaches to studying and academic performance. The summary of research using RASI to examine the relationship between students' academic performance and approaches to studying is presented in Table 2.

Sadler-Smith (1996) argued that the lack of the relationship between approaches to studying and academic performance was due to the RASI's poor ability to adequately capture students' approaches to studying. He also suggested that prior academic performance measured as an aggregate score for various assessments was a more appropriate and direct measure of students' approaches to studying. However, that idea was not adopted in further research and self-reported questionnaires were perceived as a very much more adequate way of assessing students' approaches to studying.

Table 2: *Summary of Studies Examining the Relationship Between Approaches to Studying Measured by RASI and Students' Academic Performance in Higher Education.*

				Revised Approaches to Studying Inventory (RASI) Cross-sectional studies				
					Correlation coefficient			
Reference	Sample	AP	Analysis		Deep	Strat	Surf	Conclusion
(Sadler-Smith, 1996)	61 computing; 34 accounting; 64 business; 58 other; undergraduates	Core module assessment (case study, test and essay); aggregate score for 12 modules	Correlation		.25**	.14	-.11	The deep approach positively correlated with aggregate score and the strategic approach positively correlated with multiple-choice tests (accounting students only). The surface approach negatively correlated with aggregate scores (computing students only).
(Sadler-Smith & Tsang, 1998)	UK: 225 undergraduates Hong Kong: 183 undergraduates	UK: core module assessment, total score for 12 modules Hong Kong: cumulative GPA and term GPA	Correlation		UK =.11 Hong Kong = .04	.04 .08	-.09 -.03	The deep approach positively correlated with aggregate score (the UK sample). Both strategic and surface approaches to studying did not correlate with AP.

Table 2: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Duff, 2003)	75 part-time postgraduate students	Aggregate score for the course	SEM	-	-	-	The deep approach (especially on report assessment) and the surface approach explained lower AP, whereas the strategic approach explained higher AP.
(Duff, 2004)	60 - 1st year accounting students	*Current:* Aggregate score for the semester assessments *Prior:* School GPA	Correlation	.36*	.18	-.06	The deep approach positively correlated with AP, whereas strategic and surface approaches did not. Prior AP at school was the best correlate of AP at university.
(Duff, Boyle, Dunleavy, & Ferguson, 2004)	146 social science undergraduates	Average year GPA over 8 modules	Correlation	.1	.15	-.05	Approaches to studying did not correlate with AP.
(Minbashian, Huon, & Bird, 2004)	49 - 3rd year psychology undergraduates	Quality and quantity of examination answers	Correlation and regression	.13	-	.09	Quality of the answers linearly related to the deep approach, whereas quantity of answers quadratically related to the deep approach (inverted U).

"-" Correlation coefficient was not reported; AP – academic performance.

The research examining the relationship between approaches to studying and academic performance was also interested whether there were any culture differences in (a) students' approaches to studying and (b) the relationship between approaches to studying and academic performance. Sadler-Smith and Tsang (1998) examined cultural differences in approaches to studying in samples of UK and Hong Kong undergraduate students. Initially there was no difference between the two samples in their levels of deep, surface and strategic approaches to studying. However, there were culture differences in the relationship between the deep approach to studying and academic performance. Thus, in a Hong Kong student sample there was no relationship between approaches to studying and academic performance, whereas in a UK student sample a weak positive relationship was observed. As such, these findings indicated that educational environment does not affect the development of approaches to studying as much as it affects the relationship between approaches to studying and academic performance. However, the difference between the two groups of students was very small suggesting that overall approaches to studying rather poorly explained learning progress.

All studies reviewed so far employed samples of full-time undergraduate students. Duff (2003) was the first one to use a sample of part-time postgraduate students to examine the relationship between approaches to studying and academic performance. The results of

structural equation modelling (SEM) identified that the surface approach to studying explained lower academic performance and the strategic approach to studying explained higher academic performance. Contrary to the previous research findings, the deep approach to studying had a negative relationship with academic performance i.e., undermined academic performance. However, the effect size for this relationship was rather small.

One possible explanation for this unusual result is that part-time students have fewer resources to dedicate to learning due to other commitments. As such, in order to achieve the desired learning progress, part-time students need to be target-oriented and organised in their studying. All these characteristics are defining qualities of strategic approach to studying. Therefore, using the deep approach to studying, which does not require such a high level of organisation, can be maladaptive.

Looking at the inconsistent relationship between approaches to studying and academic performance, Minbashian, Huon and Bird (2004) aimed to identify possible reasons underlying this inconsistency. They examined the correlation between deep and surface approaches to studying and quantity and quality of examination answers. The quantity of examination answers was determined by accuracy in definitions, researchers' names and dates, whereas quality of answers was based on

Biggs' and Collis' (1982) SOLO taxonomy e.g., variety of concepts, integration of concepts and abstraction principles.

Approaches to studying overall failed to explain examination scores. However, more detailed analysis revealed that the deep approach linearly related to the quality of examination answers and quadratically relate to the quantity of examination answers (both quality and quantity accounted to 72% of variance in overall examination grade). As such, students who were in the high deep approach group produced a lower quantity of answers than the medium deep approach group or even the low deep approach group. The medium deep approach group scored the highest on quantity score.

It is unclear why students with high levels of the deep approach to studying produced answers that were less factually detailed; however, it is possible that deep learners prioritise description of the overall picture over factual details i.e., make factual sacrifice under the examination pressure. In this study, students were required to answer four essay-type questions within an hour, which fostered the trade off between quality and quantity. The relationship between the strategic approach to studying and quality and quantity of the examination answers was not analysed.

Furthermore, the relationship between approaches to studying and academic performance was tested statistically controlling for prior academic performance. Duff (2004) was the only one to carry out such analysis using the RASI scale. Approaches to studying overall failed to

explain academic performance. However, the cluster analysis indicated that students in the "ineffective learners" cluster had higher levels of the surface approach to studying and lower prior and current academic performance, whereas students in the "effective learners" cluster had a higher level of deep learning and higher prior and current academic performance.

1.1.5   Approaches and Study Skills Inventory for Students (ASSIST) and academic performance

The majority of the research using ASSIST scale found a meaningful relationship between approaches to studying, in particular, the strategic approach and students' academic performance. In contrast to the results obtained using ASI and RASI, the deep approach measured by ASSIST showed the weakest and the most inconsistent relationship with academic performance. The summary of the research using the ASSIST scale to investigate the relationship between approaches to studying and academic performance is presented in Table 3.

Table 3: *Summary of Studies Examining the Relationship Between Approaches to Studying Measured by ASSIST and Students'*
Academic Performance in Higher Education.

Approaches and Study Skills Inventory for Students (ASSIST)

Cross-sectional studies

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Cassidy & Eachus, 2000)	130 social science undergraduates	Research Methods aggregate score	Correlation	-	.18[*]	-	Only the strategic approach to studying correlated with AP.
(Byrne, Flood, & Willis, 2002)	95 – 1st year accounting students	End-of-semester module grade	Correlation	.22[*]	.29[**]	-.34[**]	Deep and strategic approaches positively correlated with AP, whereas the surface approach negatively correlated with AP.
(Diseth & Martinsen, 2003)	192 psychology undergraduates	4-hour essay-type and multiple-choice examination	Correlation and SEM	.06	-	-.19	The deep approach did not explain AP, whereas the strategic approach explained higher AP and the surface approach explained lower AP.
(Diseth, 2003)	151 psychology; 164 logic and philosophy undergraduates	4-hour essay-type and multiple choice examination	Correlation	.04 .31[**]	.10 .18	-.31[**] -.16	The deep approach positively correlated with AP (logic and philosophy students sample), whereas the surface approach negatively correlated with AP (psychology students sample).

Table 3: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Diseth, Pallesen, Hovland, & Larsen, 2006)	476 introduction course psychology students	4-hours essay-type and multiple choice examination	Correlation and SEM	.19**	.24**	-.18**	Despite the meaningful correlation between approaches to studying and AP, they failed to explain AP.
(Burton & Nelson, 2006)	97 - 1st year distance learning psychology students	Cumulative end of the year GPA	Correlation and regression	.21*	.25*	-.23*	All approaches to studying meaningfully correlated with AP, but only the surface approach explained lower AP.
(Reid, Duvall, & Evans, 2007)	Sample ranged from 130 to 189 2nd year medical students over a period of five years	Multiple choice examination, essay-type examination, in-course assessment, peer assessment	Correlation	.04	.14	-.07	Deep (12 times out of 87) and strategic (22 times out of 87) approaches to studying positively correlated with AP, whereas the surface approach negatively correlated with AP (15 times out of 87).
(Brodersen, 2007)	174 baccalaureate nursing students	Current: Final GPA Prior: total GPA and ACT	Correlation	.16*	.39**	-.37**	Deep and strategic approaches positively correlated with AP, whereas the surface approach negatively correlated with final course grade and prior cumulative GPA.

Table 3: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	*Strat*	*Surf*	
(Diseth, 2007)	178 introduction course psychology students	*Current*: 6-hour essay-type and multiple choice examination *Prior*: self-reported school GPA (HSGPA)	Correlation and SEM	.25**	.32**	-.45**	Deep and strategic approaches positively correlated with AP, whereas the surface approach negatively correlated with AP. HSGPA was the strongest correlate of AP at university.
(Rodriguez, 2009)	131 business undergraduate students	GPA	SEM	-	-	-	The deep approach explained the strategic approach. The strategic approach in its turn, explained higher AP. The surface approach to studying failed to explain AP.
(Huws, Reddy, & Talcott, 2009)	106 - 1st year psychology undergraduates	GPA	Correlation	.27**	.37**	-.25**	Deep and strategic approaches positively correlated, whereas the surface approach negatively correlated with AP.
(Diseth, Pallesen, Brunborg, & Larsen, 2010)	442 introduction psychology undergraduates	*Current*: examination *Prior*: self-reported school GPA (HSGPA)	Correlation and SEM	.3**	.43**	-.35**	The strategic approach explained higher AP, whereas the surface approach explained lower AP. HSGPA was the strongest correlate of AP.

Table 3: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Diseth & Kobbeltvedt, 2010)	91 introduction economics; 138 introduction psychology students	4-hour exam (economics); 6-hour exam (psychology)	Correlation and SEM	.04	.31**	-.16*	The strategic approach positively correlated, whereas the surface approach negatively correlated with AP. Only the strategic approach explained significant portion of variance in AP.
(Diseth, 2011)	177 introduction psychology course students	*Current*: Six-hours end-of-semester module examination *Prior*: self-reported school GPA (HSGPA)	Correlation and SEM	.16*	-	-.38**	The deep approach positively correlated, whereas the surface approach negatively correlated with AP and explained lower AP. HSGPA was the strongest correlate of current AP.

"-" Correlation coefficient was not reported; AP – academic performance.

Diseth and colleagues carried out extensive research into the relationship between approaches to studying and academic performance. Most of their studies used undergraduate psychology students from a Norwegian University. Approaches to studying were assessed using translated version of ASSIST, which was inconsistent in its reliability from study to study. Overall, the results of seven studies identified a positive relationship between the deep approach and academic performance in six studies (Diseth & Kobbeltvedt, 2010; Diseth et al., 2010; Diseth, Pallesen, Hovland, & Larsen, 2006; Diseth, 2003, 2007, 2011) and failed to do so only once (Diseth & Martinsen, 2003). The strategic approach to studying positively correlated with academic performance also in six studies (Diseth & Kobbeltvedt, 2010; Diseth & Martinsen, 2003; Diseth et al., 2010, 2006; Diseth, 2007) and failed to do so only once (Diseth, 2003). The surface approach to studying negatively correlated with academic performance in all seven studies (Diseth & Kobbeltvedt, 2010; Diseth & Martinsen, 2003; Diseth et al., 2010, 2006; Diseth, 2003, 2007, 2011).

In addition, Diseth and Martinsen (2003) and Diseth and Kobbeltvedt (2010) found that the strategic approach explained higher academic performance and the surface approach explained lower academic performance (Diseth & Martinsen, 2003). However, these results were not replicated in the subsequent study (Diseth et al., 2006).

Researchers also examined whether approaches to studying accounted for any additional variance in academic performance to that accounted for by prior academic performance (self-reported High School Grade Average (HSGPA)). Overall, Diseth (2007, 2011) and Diseth et al. (2010) found that self-reported HSGPA was the strongest correlate of examination grade followed by surface (Diseth 2007, 2011; Diseth et al., 2010) and strategic (Diseth et al., 2010) approaches to studying. The strategic approach to studying was also a mediator between effort put towards studying and examination performance (Diseth et al., 2010).

Overall, the results of Diseth and colleagues research showed that strategic and surface approaches to studying were stronger correlates of students' academic performance than the deep approach to studying. As such, the authors concluded that in order to improve students' academic performance, it is more important to prevent/discourage the surface approach to studying than promote/encourage the deep approach to studying. Additionally, the authors argued that the weak relationship between self-reported SHGPA and university examination performance indicated that approaches to studying develop independently of prior academic experience and prior academic performance.

In contrast to previously reviewed studies that used "traditional" students, Burton and Nelson (2006) examined whether approaches to studying were important correlates of learning for distance learning students. The results overall showed that, deep and strategic approaches

to studying positively correlated with students' academic performance, whereas the surface approach negatively correlated with students' academic performance. However, regression analysis showed that only the surface approach to studying explained students' academic performance. The authors concluded that distance learning students were mainly preoccupied with the idea of survival rather than achievement at the start of their university degree and as such, they mainly relied on rote-learning. In all, the results of this research were consistent with the findings from other studies.

The most detailed investigation into the relationship between approaches to studying and academic performance was done by Reid, Duvall and Evans (2007). They assessed approaches to studying and academic performance in five sequential cohorts of 2nd year undergraduate students. During a five-year period they recorded students' academic performance using multiple-choice tests, essay-type examinations and in-course assessments.

Multiple-choice tests were administered 16 times. From that, deep, strategic and surface approaches to studying correlated with the tests results only in 4 instances. Essay-type examinations were administered 57 times. From that, the deep approach correlated with examination results only in 7 instances, the strategic approach only in 15 instances, and the surface approach only in 11 instances. In-course assessments were administers 14 times. From that, the deep approach

correlated with assessments results only once, the strategic approach only 3 times, and the surface approach did not correlate at all. Overall, the strongest correlation was observed between the strategic approach to studying and academic performance. Conclusively, approaches to studying were poor correlates of learning and academic performance.

In contrast to previous research where approaches to studying were tested in relation to academic performance as equal, Rodriguez (2009) tested a model where the strategic approach to studying mediated the relationship between the deep approach and academic performance and the surface approach and academic performance. The results showed that the strategic approach indeed mediated the relationship between the deep approach to studying and academic performance. However, this model lacked theoretical grounding and was not tested appropriately. The deep approach to studying was consistently found to correlate moderately with the strategic approach. As such, the path from the strategic approach to the deep approach (i.e., a reversed model) also had to be tested. The authors' conclusion would be possible only if the path from the strategic approach to studying to the deep approach to studying was non-significant. This reversed relationship was not tested and as such, the authors' conclusion lacks empirical support.

In all, ASSIST showed to be a better measure of approaches to studying than its ancestors ASI and RASI. Strategic and surface approaches to studying correlated moderately with academic performance

only in some studies, and the relationship was inconsistent. Importantly, there were only few studies that partialed out the effect of prior academic performance from the relationship between approaches to studying and academic performance. As a result, the relationship between approaches to studying and academic performance disappeared, indicating that approaches to studying were poor correlates of students' academic performance.

1.1.6 Study Process Questionnaire (SPQ) and Two-factor Study Process Questionnaire (R-SPQ-2F) and academic performance

The overall research results were similar to the findings obtained from the research using ASI and RASI. The summary of studies using SPQ and R-SPQ-2F is presented in Table 4.

Research by Eley (1992) was the first one to establish a positive relationship between approaches to studying measured by SPQ and academic performance. Both deep and achieving approaches to studying correlated positively with academic performance, whereas the surface approach to studying correlated negatively with academic performance. This research was also the first one to look at the stability of the approaches to studying. This study measured students' approaches to studying in each subject separately rather than in general in Higher Education. Such design enabled evaluation of the effect the course

Table 4: *Summary of Studies Examining the Relationship Between Approaches to Studying Measured by SPQ and R-SPQ-2F, and Students' Academic Performance in Higher Education.*

				Study Process Questionnaire (SPQ)			
				Cross-sectional studies			
Reference	*Sample*	*AP*	*Analysis*	*Correlation coefficient*			*Conclusion*
				Deep	*Achiev*	*Surf*	
(Beckwith, 1991)	105 - 1st year undergraduates	Multiple choice tests	Correlation	-	-	-	Approaches to studying did not correlate with AP.
(Eley, 1992)	74 biochemistry and microbiology; 152 financial accounting and business law; 54 chemistry and mathematics; 40 English literature and politics of philosophy students ; total of 320 2nd year undergraduates	Marks on a course unit pairs	Correlation	.22*	.35*	-.23*	Deep and achieving approaches positively correlated with AP, whereas the surface approach negatively correlated with AP.
(Hall, Bolen, & Gupton, 1995)	532 undergraduate psychology degree students	Overall GPA	Correlation	-.07	-.1	.02	Approaches to studying did not correlated with AP.

Table 4: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	Achiev	Surf	
(Kember, Jamieson, Pomfret, & Wong, 1995)	34 male mechanical engineering students	GPA	Correlation	.23	.18	.2	Approaches to studying did not correlate with GPA.
(Rose, Hall, Bolen, & Webster, 1996)	202 undergraduate psychology students	Overall GPA	Correlation and Regression	-.11	-.27**	-.02	The strategic approach to studying negatively correlated with AP and accounted for 2% of variance in GPA.
(Drew & Watkins, 1998)	41 nursing; 65 radiography; 56 language and communications students	Overall end-of-year grade	Correlation and SEM	.2	-	-.23*	The deep approach explained higher AP, whereas the surface approach explained lower AP.
(Cantwell & Moore, 1998)	207 final-year Diploma of Nursing students	Overall GPA	Correlation	.14*	.17**	-.12	Deep and achieving approaches to studying positively correlated with overall GPA.
(Booth, Luckett, & Mladenovic, 1999)	128 accounting undergraduates (objective AP) 347 accounting undergraduates (self-reported AP)	Objective: aggregated course grade	Correlation	.01	-	-.22*	The deep approach did not correlate with subjective and objective measures of AP, whereas the surface approach negatively correlated with both.

Table 4: Continue

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	*Achiev*	*Surf*	
(Davidson, 2002)	211 undergraduate accounting students	Examination scores on low and high complexity questions	Correlation and regression	-.07	-	.04	Approaches to studying did not correlate with AP. However, the deep approach explained better AP on high complexity questions.
(Zeegers, 2004)	255 - 1st year; 132- 3rd year; total 387 undergraduates	*Current:* Overall GPA score *Prior:* TES and prior GPA	Correlation and SEM	.16*	-	-.23**	The deep approach (including achieving approach) explained higher AP, whereas the surface approach explained lower AP. The relationships between approaches to studying and GPA did not hold when controlling for prior AP.

Study Process Questionnaire (SPQ)
Longitudinal studies

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	*Achiev*	*Surf*	
(Zeegers, 2001)	Trial 1 n= 174; trial 2 n= 148; trial 3 n= 122; trial 4 n= 60; trial 5 n= 52 science undergraduates	GPA	Correlation	.26	.15	.16	Deep (trial 2, 3, 4, 5) and achieving (trial 2) approaches positively correlated with AP, whereas the reproduction approach negatively with AP (trial 2).

Table 4: Continue

***Two Factor Study Process Questionnaire* (R-SPQ-2F)**
Cross-sectional studies

Reference	Sample	AP	Analysis	Correlation coefficient			Conclusion
				Deep	*Achiev*	*Surf*	
(Betoret & Artiga, 2011)	84 - 3rd year psychology students; 50 3rd year teacher training course students; 23 2/3 year educational psychology students	Single module test score	Correlation	.16*	-	-.3**	The deep approach positively correlated, whereas the surface approach negatively correlated with AP.
(Loyens, Gijbels, Coertjens, & Côté, 2013)	106 - 1st year psychology students	Multiple choice test; knowledge application	Correlation and SEM	-.12	-	.09	Approaches to studying did not correlate with AP.
(Salamonson et al., 2013)	476 nursing; 75 engineering; 77 medicine; 204 health science; 87 medical chemistry 1st year students	Overall assessment scores	Hierarchical regression	-	-	-	The deep approach explained higher AP, whereas the surface approach explained lower AP.

"-" Correlation coefficient was not reported; AP – academic performance.

perception (reflective vs. defined) had on students' preference for a particular approach to studying.

Overall, the deep approach to studying was higher in English literature students and the surface approach was higher in science students (biochemistry, chemistry and accounting). However, there was no difference in the achieving approach to studying across students from different subjects. Eley (1992) also discovered that students' approaches to studying slightly changed from subject to subject, but the change was marginally small. This suggests that approaches to studying are relatively stabile.

Furthermore, Scouller (1998) examined the effect of the assessment type rather than subject per se on students' approaches to studying. He found that students were more likely to employ the surface approach to studying when preparing for a multiple-choice examination, whereas they were more likely to employ deep learning strategies when preparing for an essay. In addition, Scouller (1998) found that students who preferred essays to examinations showed preference for the deep approach when preparing for the essay and achieved higher grades on essay assignments. However, the same difference was not observed for examination results for students who preferred examination assignments.

A study by Davidson (2002) in contrast to earlier studies using SPQ failed to find the meaningful relationships between deep and surface approaches to studying and academic performance. However, he found

that deep approach to studying correlated with examination results on high complexity questions only. These findings further supported the importance of deep approach for better learning and understanding of the complex material.

Hall, Bolen and Gupton (1995) further looked at the relationship between approaches to studying and academic performance in high and low achievers. They found that the achieving approach to studying accounted for a significant portion of variance in GPA only in high achieving students. However, Rose, Hall, Bolen and Webster (1996) found the opposite for the achieving approach. Their results showed that the achieving approach to studying negatively correlated with academic performance. The authors however did not give any explanation for this unusual result. They also failed to report reliability of the SPQ scale, which could partly explain this unusual correlation between achieving approach and academic performance.

All the research reviewed so far employed cross-sectional design. Zeegers (2001) was the first one to conduct a longitudinal research examining how students' approaches to studying change throughout their undergraduate degree. He followed a sample of science students for three years measuring their approaches to studying. Approaches to studying were measured five times: in the first month of studying, four months, eight months, sixteen months and thirtieth months into studying.

Their results strongly indicated the decrease in the achieving approach to studying throughput the degree. Interestingly, there was no change in either deep or surface approaches. Furthermore, the deep approach consistently correlated positively with GPA scores, and the relationship became stronger over the years. In contrast, surface and achieving approaches to studying were not associated with academic performance. However, these findings were based on the progressively unreliable assessment of approaches to studying and the decreasing sample size. The analysis of the GPA on dropouts and continuing students identified that those who dropped out from this study had significantly lower GPA than those who continued; as such, underperforming students were underrepresented in later stages of the research. Therefore, the results are only indicative of the facilitative effect the deep approach to studying has on learning and academic performance in later years of a degree.

Zeegers (2004) also examined the relationship between approaches to studying and academic performance controlling for the effect of prior academic performance. The results supported the positive relationship between deep approach and the negative relationship between surface approach and academic performance. However, the relationship did not hold when prior academic performance was controlled for. Furthermore, in this study the deep approach to studying was assessed by an aggregate score of deep and achieving approaches. As such, the more

appropriate interpretation for this study results is that adaptive approaches to studying positively correlate with academic performance rather than deep approach per se.

In all, the observed correlation patterns between approaches to studying measured by SPQ were the same as in studies using ASI and RASI. A large portion of the reviewed research reported SPQ to be unreliable especially on the scales of surface and deep approaches.

The relationship between approaches to studying measured by R-SPQ-2F and academic performance was mainly investigated in the non-English speaking populations. The translated versions of R-SPQ-2F scale showed rather poor reliability and as such, results of these studies should be considered in light of this key limitation.

The largest study using R-SPQ-2F was carried out by Salamonson et al. (2013). They used a sample of 919 students from five different disciplines to examine the relationship between deep and surface approaches to studying, and overall academic performance. The deep approach explained higher academic performance, whereas the surface approach explained lower academic performance. Comparison between students from different subjects revealed that students from medical chemistry reported the highest level of the deep approach to studying, whereas students from health science reported the lowest use of the deep approach to studying. However, statistically there was no difference across five disciplines in levels of the surface approach to studying.

1.1.7 Overall evaluation of the relationship between approaches to studying and academic performance

A comprehensive summary of the research examining the relationship between approaches to studying and academic performance comes from two meta-analytic studies accounting for over 30 years of research (Richardson, Abraham, & Bond, 2012; Watkins, 2001). Both studies used somewhat different criteria for selecting studies, but the results were quite similar. The meta-analytic studies' summary is presented in Table 5. These two studies overall supported positive relationships between deep and strategic approaches, and a negative relationship between the surface approach to studying and academic performance. However, based on the literature review presented in this chapter it is still unclear whether approaches to studying are important psychological correlates of learning.

The average correlation coefficient for the relationships between approaches to studying and academic performance were calculated using correlation coefficients reported in reviewed studies (not all studies reported correlation coefficients). On average, correlation coefficient for the relationship between the deep approach and academic performance was .163, between the strategic approach and academic performance was .197, and between the surface approach and academic performance was -.15.

Table 5: *Summary of Meta-analytic Research Examining the Relationship Between Approaches to Studying and Academic Performance.*

Reference	Sample	AP	Analysis	Meta-analysis (ASI, RASI and SPQ) Correlation coefficient			Conclusion
				Deep	Strat	Surf	
(Watkins, 2001)	SPQ = 6576 university students ASI = 1446 university students RASI = 653 university students	Not specified	Meta analysis	ASI =. 17 RASI = .18 SPQ = .16 Total= .17	.17 .1 .18 .15	-.13 -.07 -.11 -.1	Deep and strategic approaches correlated positively, whereas the surface approach related negatively with AP.
(Richardson, Abraham, & Bond, 2012)	Deep approach - 23 studies (n=5211) Strategic approach - 15 studies (n=2774) Surface approach - 22 studies (n=4838)	GPA	Correlation and regression	.14	.23	-.18	Deep and strategic approaches showed small positive correlation, whereas the surface approach showed small negative correlation with GPA. The strategic approach was the strongest correlate of GPA, followed by surface and then deep approaches. Together they accounted for 9% of variance in GPA.

"-" Correlation coefficient was not reported. AP – academic performance.
Note: Watkins (2001) meta-analysis included studies with children and studies using other questionnaires which were not part of this literature review and therefore the correlation coefficients were recalculated manually to obtain more meaningful findings in relation to this literature review.

Looking at the average correlation coefficients for all studies it is evident that the relationship between approaches to studying and academic performance was rather weak. The overall strongest correlation was observed between the strategic approach to studying and academic performance followed by deep and surface approaches. Conclusively these findings indicate that adaptive approaches to studying are superior to the maladaptive approach to studying in their relationship with academic performance.

Furthermore, ASSIST was found to be the most reliable measure of approaches to studying even though the surface approach subscale occasionally failed to reach adequate reliability. ASSIST scale also showed overall better predictive validity than other measures. On average studies using ASSIST reported correlation coefficient of $r = .175$ for the relationship between the deep approach to studying and academic performance, correlation coefficient of $r = .278$ for the relationship between the strategic approach to studying and academic performance and correlation coefficient of $r = -.257$ for the relationship between the surface approach to studying and academic performance. These correlation coefficients compared with correlation coefficients of other scales: ASI at $r = .129$ (deep), $r = .26$ (strategic) and $r = -.101$ (surface), RASI at $r = .161$ (deep), $r = .137$ (strategic) and $r = -.061$ (surface), and SPQ and R-SPQ-2F at $r = .085$ (deep) $r = .08$ (strategic) and $r = -.069$ (surface), indicate that, at present, ASSIST is evidently the most

appropriate scale to use when examining the relationship between approaches to studying and academic performance.

In conclusion, the review strongly indicated that prior academic performance is the strongest correlate of following academic performance. The relationship between prior and following academic performance ranged from weak to moderate mainly due to: 1) the majority of the research useing self-reported prior academic performance, 2) the two measures of academic performance were usually incompatible i.e., HSGPA and university examination. As a result, approaches to studying in some studies remain significant correlates of academic performance even when controlling for the effect of prior academic performance. The literature review did not identify a single study that examined the effect of approaches to studying on academic performance when statistically controlling for the effect of actual and compatible academic performance e.g., controlling for the previous semester/year results for each assessment type and controlling for the measurement error in performance.

Furthermore, Clarke's (1986) research results strongly indicated that the component of the ASI scale measuring negative attitudes to studying (affective component of the scale) had a strong negative relationship with examination performance and the relationship was more consistent across all years of the degree. This led Clarke (1986) to the conclusion that emotional rather than cognitive components of learning

are better at explaining academic performance. However, little is known about the effect of emotions on learning and academic performance.

1.2   Emotions in Studying

Over the past 50 years cognitivism largely dominated the field of general psychology. As a result, psychology was generally perceived as a science of thinking, intellect and reasoning (Gardner, 1985). It was particularly evident in educational psychology research, which was predominantly concerned with investigating intellectual and cognitive correlates of learning. Emotional aspects of learning or simply emotions in education were largely ignored.

Emotions people experience can be broadly separated into two categories/states of feeling good or feeling bad. These broad states are referred to as positive and negative 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).

The circumplex model of emotions provides basic classification for all emotions. It classifies emotions into four categories based on their valence (positive-negative) and level of activation (high-low). Thus, feeling happy is a positive valence and high activation emotion, whereas

feeling satisfied is a positive valence low activation emotion (Russell & Carroll, 1999). Importantly, according to the circumplex model, positive affect and negative affect are orthogonal constructs. This implies that feeling positive emotions does not by default imply the absence of negative emotions, and vice versa.

Research indeed supported the independence of positive and negative affect by observing a lack of the relationship between the two (e.g., Green, Goldman, & Salovey, 1993; Watson, Clark, & Tellegen, 1988; Watson & Clark, 1997). As such, an individual can feel both positive and negative emotions at the same time. This orthogonal nature of positive and negative affect is paramount to understanding how emotions affect learning and academic performance.

1.2.1   Evaluation and test anxiety

Even though overall emotions in studying were of little interest in education, researchers were fascinated by the effect of anxiety (particularly test anxiety) on learning and academic performance. Anxiety is a mood condition that arises from an individual's perception of one's own inability to cope with future situations that are perceived as threatening, uncontrollable and unavoidable (Barlow, 2000; Barlow, Chorpita, & Turovsky, 1996). Anxiety that is specific to the evaluative situations (where a person's performance is evaluated or judged by others) is referred to as evaluation anxiety (Geen, 1991). Evaluation

anxiety is an umbrella term for different types of anxiety like test anxiety, statistical test anxiety, and performance anxiety (Skinner & Brewer, 1999; Zeidner & Matthews, 2005).

Currently, evaluation anxiety is conceptualised as a set of phenomenological, psychological and behavioural responses to the possible negative outcome in evaluative situation (Zeidner, 1998). The main concern in evaluation anxiety research is whether evaluation anxiety is best conceptualised as a relatively stable trait or an emotional state. On the one hand, when evaluation anxiety emphasises individual predisposition to feel anxious in evaluative situations, it can be referred to as an affective trait. On the other hand, when evaluation anxiety emphasises the fluctuation in the levels of anxiety in evaluative situations, it can be referred to as an affective state. More often test anxiety is defined as a situation-specific personality trait (Spielberger & Vagg, 1995).

Evaluation anxiety was extensively researched in its relation to examinations. The first empirical study was conducted by Folin, Demis and Smillie (1914; as cited by Spielberger & Vagg, 1995) who found around 18% of students showing significantly higher glycosuria levels (sign of elevated anxiety levels) following an examination. However, the pioneering research on test anxiety was carried out by Mandler and Sarason (1952), and Sarason and Mandler (1952) who were first to find the relationship between test anxiety and academic performance. They

detected that test anxious individuals overall performed worse on examinations than their non-anxious peers. Since then, a vast number of empirical studies were directed to examine the undermining effect of evaluation anxiety on students' cognitive processing, memory, learning and academic performance (for a review see Zeidner, 1998).

Overall, within education, evaluation anxiety was considered to be one of the most important psychological correlates of learning. Research on evaluation anxiety generally looked separately at the effects of the cognitive component and the affective component of evaluation anxiety on academic performance. The cognitive component (worry) was found to have an overall stronger effect on learning than the affective component (tension) (for a review see Zeidner, 1998).

1.2.2   *Control-value theory of achievement emotions*

Pekrun (2000, 2006) proposed a *control-value theory of achievement emotions*, which provided an integrative framework for studying emotions in education. The theory builds on traditions from expectancy-value theory of emotions[2] (Pekrun, 1992; Turner & Schallert, 2001) and incorporates aspects of transactional theory of stress appraisals

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[2] The expectancy-value theory of emotions postulates that effect of emotions on learning and academic performance of students is mediated by cognitive and motivational mechanisms (Pekrun, 1992; Turner & Schallert, 2001).

and related emotions[3] (Folkman & Lazarus, 1985), attributional theory of achievement motivation and emotion[4] (Weiner, 1985), and general models of emotions (e.g., Fredrickson, 1998, 2001; Pekrun, Goetz, Titz, & Perry, 2002; Pekrun, 1992).

The control-value theory is concerned with achievement emotions that are defined as affective multi-component phenomena and comprise of "cognitive, motivational, expressive, and peripheral physiological processes" (Pekrun, 2006, p. 316). Achievements emotions are "tied directly to the achievement activities or achievement outcomes" (Schutz & Pekrun, 2007, p. 15). As such, the theory states that all achievement emotions should be studied in relation to specific learning situations and learning outcomes i.e., *object focus*.

The proximal determinants of achievement motions are *control appraisal* (high subjective control vs. low subjective control) and *value appraisal* (subjective hierarchy of desired outcomes from an activity/situation). However, the theory also posits that emotions can

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[3] The transactional theory of stress appraisals and related emotions operationalizes stressful encounter as a dynamic process, which affects the emotional experience throughout the duration of stressful event. As such, stressful situations sometimes lead to experiencing conflicting emotions (Folkman & Lazarus, 1985).

[4] The attributional theory of achievement motivation and emotion posits that locus, stability and controllability are three primary factors affecting perception of success and failure and in essence, determine the variety of emotional experiences (Weiner, 1985).

modify control and value appraisals. Thus, on the one hand, the theory states that achievement emotions influence cognition, motivation and self-regulation or other-regulation of learning, which in their turn mediate the relationship between achievement emotions and learning outcomes. On the other hand, the theory postulates that learning outcomes influence emotions that students experience in studying. The control-value theory furthermore acknowledges that despite control and value appraisals, emotions people experience in achievement situations are also determined by temperament and numerous personality traits.

Nine achievement emotions were identified in total and were categorised into three broad kinds: activity emotions (enjoyment, boredom and anger), outcome prospective emotions (hope, anxiety and hopelessness) and outcome retrospective emotions (pride, relief and shame). All nine achievement emotions were then further subdivided according to their affective *valence* (positive vs. negative) and degree of *activation* (activating vs. deactivating).

In relation to learning and achievements, valence and activation were found to be the most influential dimensions of achievement emotions. As such, in education context, achievement emotions were grouped into *positive activating emotions* (enjoyment, hope and pride), *positive deactivating emotions* (relief and relaxation), *negative activating emotions* (anger, anxiety and shame) and *negative deactivating emotions* (hopelessness and boredom).

The theory postulates that activity irrelevant negative emotions (e.g., worry about upcoming examination or assessment) would deprive students of the necessary cognitive resources and therefore, would undermine academic performance. In contrast, activity relevant positive emotions (e.g., enjoyment) would help to focus attention on a task at hand and consequently would facilitate learning and academic performance.

The relationship between positive deactivating emotions and negative activating emotions, and learning and academic performance is more complex. On the one hand, the experience of anxiety prior to examination could reduce motivation to put effort into studying. However, on the other hand, anxiety arising from fear of failure would reinforce efforts put towards learning.

Overall, the control-value theory (Pekrun, 2000, 2006) views emotions as both antecedents and consequences of study behaviour, studies specific emotions, and emotions are researched from motivational and cognitive perspectives. The main weakness of the control-value theory is its failure to account for non-achievement emotions in learning. The theory neither rejects nor accepts that non-achievement emotions can play an important role in learning.

Furthermore, the control-value theory incorporates aspects of motivation, cognition and emotions and therefore accounts for their joint effect on learning, rather than the effect of emotions per se. This theory also conceptualises some states as emotions. For example the control-

value theory views relaxation and anxiety, which both have stronger cognitive (worry) and physiological (arousal) components than affective components, as achievement emotions. As such, this theory does not allow studying the effect of affective/emotive states on leaning and academic performance independently from the effects of motivation and cognition. Therefore, other general theories of emotions should be evaluated in their relevance to education.

1.2.3   Control-process theory

Carver and Scheier (1990, 2001) proposed the *control-process* theory of self-regulation of behaviour. This theory adopts motivational perspective on emotions and accounts for the origin and function of positive and negative affect. In contrast to the control-value theory, the control-process theory makes no conceptual distinction between affect and emotions. The control-process theory is only concerned with valence (positive vs. negative) and intensity (high vs. low) of affect. This theory comes from personality-social psychology and is applied in health, organisational, clinical and counselling psychology to understand reasons for certain human behaviour.

The control-process theory postulates the existence of two feedback loops: behaviour-guiding loop and affect-creating loop. The behaviour-guiding loop is concerned with "distance" between the present state and the desired state and its main function is to guide a person's

effort and behaviour towards the goal. The affect-creating loop on the other hand, is concerned with "velocity" and provides information about an individual's rate of progress towards the goal i.e., rate of discrepancy reduction between current and desired states. Both loops operate simultaneously in a way that the affect-creating loop provides information needed for the adjustment of the behaviour-guiding loop.

Neutral affect signifies that an individual's progress is in line with the desired rate of progress. As such, when an individual experiences neutral affect no adjustment to the behaviour is needed. Positive affect indicates that an individual's progress is faster than expected, whereas negative affect indicated that the progress is slower than expected. As such, an individual experiencing positive affect will reduce the effort put towards the goal accomplishment (i.e., engage in coasting), whereas an individual who experiences negative affect will put more effort towards the goal accomplishment. The ultimate goal for the adjustment of the behaviour is to have a balance between effort and progress that is signified by the experience of neutral affect.

However, the balance between the effort and discrepancy reduction is rare, in particular when the goal is a "moving target goal". The prime example of such a goal is the goal to progress in one's learning or career. The progress towards achievement of a "moving target goal" does not solely depend on the effort one puts towards its accomplishment, but it is largely determined by change in strategy and choice for actions.

As such, an individual is more likely to experience either positive affect or negative affect as they attempt to self-regulate their goal directed behaviour by examining the efficiency of the chosen strategy and action.

Importantly, the prolonged experience of positive affect will force the increase in the progress reference value, which will lead to setting more ambitious goals. In contrast, the prolonged experience of negative affect will lead to a decrease in the progress reference value and in some cases even abandonment of the goal or part of the goal. In situations where a person experiences prolonged negative affect the adaptive strategy would be to disengage from the none-attainable goal or to replace it with a more attainable alternative.

The control-process theory adopts the circumplex model's view of positive and negative affect and accounts for simultaneous occurrence of positive and negative affect. The theory states that a person can experience conflicting emotions due to differences in a perspective taken to judge the progress and also due to their own hierarchy of goals (for a review see Carver & Scheier, 2001).

Applying the control-process theory to education, it is expected that students who experience positive affect during or after studying perceive their progress in learning faster than desired/expected. In contrast, students who experience negative affect in studying perceive their progress in learning slower than desired/expected. This interpretation of positive and negative affect in studying provides

valuable information about students' subjective judgement of their own learning progress.

It is expected that positive and negative affect will relate to the objective measure of learning progress i.e., academic performance. Thus, positive affect would correlate with higher academic performance (because the progress in learning is fast), whereas negative affect would correlate with lower academic performance (because the progress in learning is slow). Moreover, the prolonged experience of positive affect in studying on the one hand will lead to the reduced effort and coasting. This will ultimately weaken the relationship between positive affect and academic performance. The prolonged experience of negative affect on the other hand, will lead to disengagement from studying or even drop out, and correlate more strongly with academic performance during the assessment and examination time. As such, the control-process theory gives a valuable account of the relationship between students' affect and their study behaviour, and highlights the importance of students' affect in translating their intent to study into actual studying.

1.2.4 Mood-as-input theory

The *mood-as-input* theory (Martin, Ward, Achee, & Wyer, 1993) also adopts a motivational perspective on emotions, and views emotions as a means for engaging in particular behaviour and cognitive processing. However, in contrast to the control-process theory (Carver & Scheier,

1990, 2001) that simply views positive and negative affect as an indication of fast or poor progress towards the goal, the mood-as-input theory emphasises that both positive and negative emotions can facilitate or undermine an individuals' engagement with an activity/task. The mood-as-input theory posits that positive and negative affect works as a signal system for controlling start and stop mechanisms of intentional behaviour i.e., *engagement stop rule* vs. *enough stop rule*.

Martin et al. (1993) conducted two experimental studies where they examined the moderating effect of stop rules on the relationship between mood and task engagement. Participants in both experiments were randomly assigned to the experimentally induced positive mood condition or to the experimentally induced negative mood condition. In each of those groups participants were given either the enjoyment stop rule "*stop when you no longer enjoy the task*" or the enough stop rule "*stop when you have enough information/good time to stop*". The time participants stayed engaged with the task (working on a task), in both positive and negative mood conditions, was used to test the moderating effect of the stop rule.

Martin et al. (1993) discovered that participants in the negative mood condition whose task was to stop when they had enough information / good time to stop, spent significantly more time on the task than participants in the positive mood condition with the same stop rules. In contrast, participants in the positive mood whose task was to stop when

they stop enjoying the task spent significantly more time on the task than participants in the negative mood condition with the same stop rule. The results of the two studies identified that the combination of affective states and their interpretation in the context of stop rules is more important than emotional valence per se in explaining behaviour.

The authors concluded that the combination of individuals' moods and stop rules has an effect on effort people put towards completion of a task:

> […] positive moods tell us to continue when they reflect our level of enjoyment but tell us to stop when they reflect our level of goal attainment. Negative moods tell us to stop when they reflect our level of enjoyment but tell us to continue when they reflect our level of goal attainment (Martin et al., 1993 p. 325).

Thus, depending on the contextual interpretation of the mood, both positive and negative mood can have positive effect on engagement with the task.

Applying this theory to education, it is expected that students who experience positive affect in studying will interpret it as a signal of enjoyment and will spend more time and put more effort into studying. On the other hand, students who experience negative affect in studying will interpret it as a sign of not enjoying studying and will disengage from studying as soon as they reach minimal level of task completion (i.e.,

study up to pass level). As such, in line with the control-process theory and with the control-value theory, positive affect is expected to positively correlate with academic performance, whereas negative affect is expected to negatively correlate with academic performance if students interpret their affect as a sign of enjoying or not the learning process.

1.2.5 *Broaden-and-build theory*

The *broaden-and-build model* of positive emotions (Fredrickson, 1998, 2001) views emotions as antecedents rather than consequences of behaviour and takes cognitive rather than motivational perspective on their functions. The broaden-and-build theory is based on three hypotheses that explain the effect of positive emotions on human functioning. The *broaden hypothesis* states that positive emotions enhance cognition (Fredrickson & Branigan, 2005; Fredrickson & Joiner, 2002) and expand attention (Gasper & Clore, 2002) and as such, they broaden individuals' thought-action repertory. The *build hypothesis* posits that positive emotions (even short-lived ones) have long-term positive effect on physical, psychological, cognitive/intellectual and social resources (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009). Finally, the *undoing hypothesis* postulates that positive emotions prevent the diminishing and deteriorating effect of negative emotions (Fredrickson, 2001; Moneta, Vulpe, & Rogaten, 2012).

Research indeed found that experimentally induced positive mood facilitated more flexible (Hirt, 1999; Hirt, Levine, McDonald, Melton, & Martin, 1997) and inclusive (Isen & Daubman, 1984) categorisation of information, more unusual word associations (Isen, Johnson, Mertz, & Robinson, 1985), and better problem solving (Isen, Daubman, & Nowicki, 1987). Positive emotions also led to more cognitive flexibility (Hirt, Devers, & McCrea, 2008) and more divergent thinking (Vosburg, 1998).

Fredrickson (2001) defined emotions as a multicomponent affective response to a specific situation/object. She argued that emotions are more intense and short-lived than affect, have distinct functions, and belong to a particular family of emotions. Fredrickson (1998) proposed that there are four primary positive emotions that are either action-motivating or none-action-motivating. Action-motivating emotions are joy/happiness and interest/curiosity/intrigue/excitement/wonder, which differ in their arousal levels. For example, joy is high arousal emotion and interest is low arousal emotion. None-action-motivating emotions are contentment/tranquillity/serenity. They are low in arousal levels and have a primary role of experience assimilation. Fredrickson (1998) further suggested that all positive emotions when combined together produce feeling of love, which tights up all positive emotions together.

Applying the broaden-and-build theory to education, it is expected that students who experience positive emotions in learning will have more

cognitive, social, psychological and physiological resources and have wider study behaviour repertoires. This will facilitate learning and academic performance. Contrary, students who experience negative emotions will have less cognitive, social, psychological and physiological resources necessary for effective learning and as such, will lead to lower academic performance.

1.2.6 *Emotions and academic performance*

The majority of the research on affective correlates of learning looked at evaluation and test anxiety. Over 100 studies specifically looked at the relationship between test anxiety and academic performance. Taking into consideration the multidimensionality of test anxiety, its relationship with academic performance was analysed separately for cognitive (e.g., worry) and for emotional (e.g., tension) facets.

A comprehensive summary of the research examining the relationship between test anxiety and academic performance comes from two meta-analytic studies. These two studies mainly examined the research evidence from studies using student samples from United States and Europe. The results strongly indicated that the cognitive component of test anxiety correlated stronger with academic performance ($r = -.26$ (Hembree, 1988) and $r = -.29$ (Seipp, 1991)) than the emotional component ($r = -.19$ (Hembree, 1988) and $r = -.15$ Seipp (1991)).

However, the average correlation coefficients for the relationship between academic performance and either of the facets of test anxiety were rather small.

Those studies were done over 20 years ago, however, their results are similar to the results of more resent research (e.g., Cassady, 2002; Chapell et al., 2005; Tremblay, Gardner, & Heipel, 2000; Zeidner & Matthews, 2005). Conclusively, even though the relationship between evaluation anxiety and learning progress was observed time after time, evaluation anxiety was rather weak at explaining learning progress and academic performance.

In contrast to the volume of research on evaluation and test anxiety, there are only few studies that ever looked at the effect of other emotions on learning. The four reviewed theories of emotions overall predicted positive affect to positively correlate with academic performance and negative affect to negatively correlate with academic performance. Research overall found support for these relationships.

The first two studies examining the relationship between achievement emotions and academic performance found that emotions experienced in the beginning of the semester correlated with academic performance at the end of a semester (Pekrun, Molfenter, Titz, & Perry, 2000). Hence, positive achievement emotions (except relief) were found to positively correlate with academic performance, whereas negative achievement emotions were found to negatively correlate with academic

performance. Furthermore, negative achievement emotions also explained course dropout (Ruthig, Hladkyj, Hall, Pekrun, & Perry, 2002).

Similar findings were obtained by Pekrun, Elliot and Maier (2009) who found that hope and pride (outcome emotions), but not enjoyment (activity emotion), explained better mid-term examination performance, and anxiety, hopelessness and shame (outcome emotions), and boredom and anger (activity emotions) explained poorer examination performance (N= 218). These findings overall supported the predictions made by the control-value theory (Pekrun, 2000, 2006). Nevertheless, these findings are also accounted for by the other three general theories of emotions i.e., the control-process theory (Carver & Scheier, 1990, 2001), the mood-as-input theory (Martin et al., 1993), and the broaden-and-build theory (Fredrickson, 1998, 2001). They all predicted that positive emotions would correlate with higher academic performance and negative emotions would correlate with lower academic performance.

Further research more closely examined the "*object focus*" of achievements emotions. The research looked at whether there was a relationship between emotions experienced in various domains of education and academic performance (GPA) (Pekrun, Goetz, Frenzel, Barchfeld, & Perry, 2011). In this study a sample of 389 undergraduate students was employed. The achievement emotions were measured separately across three domains of studying: class related emotions, learning related emotions and test emotions.

The results overall supported a positive relationship between positive emotions (enjoyment, pride, hope and relief) and academic performance and a negative relationship between negative emotions and academic performance across all three domains of study activities. Furthermore, in contrast to the earlier research on achievement emotions in education, this study found that relief in studying correlated weakly and positively with other positive achievement emotions ($r = .21$) and also correlated weakly and positively with higher academic performance.

Importantly, even though the control-value theory predicted that the emotions' value and activation determine the effect of achievement emotions on learning, the results of this research indicated that the relationship between emotions and academic performance is largely due to emotional valence (positive vs. negative) rather than value and activation i.e., positive emotions (enjoyment, hope, pride) intercorrelated at above .78, and negative emotions (anger, anxiety, shame, hopelessness, boredom) intercorrelated at above .7.

Furthermore, the "*object focus*" of emotions was also shown to be unimportant. All positive emotions measured in different study contexts (e.g., engagement in class, engagement in learning and engagement in test) strongly loaded on the positive emotions latent factor (e.g., engagement), and all negative emotions (e.g., anger in class, anger in learning and anger in test) strongly loaded on the negative emotions latent factor (anger). As such, emotional valence was superior to other facets of

emotions in determining the nature and strength of the relationship between emotions and academic performance.

Out of all achievement emotions, boredom in studying is the most extensively researched one. Pekrun, Goetz, Daniels, Stupnisky and Perry (2010) conducted a series of exploratory cross-sectional studies and one longitudinal study to examine the effect of state and trait boredom on students' academic performance. Cross-sectional results indicated that state boredom negatively related to self-reported academic performance (N=203 German sample), and trait boredom negatively related to the end of the semester academic performance (GPA) (N=122 German sample and N=398 Canadian sample).

The results of the longitudinal study revealed that boredom had a reciprocal relationship with academic performance. Thus, boredom was both an antecedent of poor academic performance and a consequence of prior poor academic performance (N= 287). Furthermore, boredom remained a significant correlate of academic performance (final course grade) even when the effect of prior academic performance was statistically controlled for.

Similar conclusions were reached by Artino, La Rochelle and Durning (2010). They examined the effect of achievement emotions on academic performance in a sample of medical student from the United States (N=136). The results strongly indicated that enjoyment explained higher national board shelf examination scores. However, enjoyment

failed to account for any variance in the average examination grade. The overall examination grades were explained by boredom and anxiety. Furthermore, further research using a different sample of medical students from the same university (N=248) found that students who were classified as low achievers reported higher levels of negative emotions (anxiety, frustration and boredom) than students who were classified as high achievers (Artino, Hemmer, & Durning, 2011).

Taking the popularity of the control-value theory within research on emotions in education, much fewer studies looked at the effect of positive and negative affect on academic performance. Research by Dosseville, Laborde and Scelles (2012) examined whether experimentally induced positive affect during a lecture would improve students' performance on a post-lecture test (N=249).

The results were consistent with previous research in that positive affect explained higher test scores, whereas negative affect explained lower test scores. The authors used the broaden-and-build theory (Fredrickson, 1998, 2001) as a theoretical foundation for their research. However, mood-as-input (Martin et al., 1993) and control-process theories (Carver & Scheier, 1990, 2001) give equally good accounts for the observed relationship between positive and negative affect and test performance.

These results were further reinforced by the findings from cross-sectional research (N=163) (Saklofske, Austin, Mastoras, Beaton, &

Osborne, 2012). The results showed that naturally occurring positive affect positively related with year GPA. However, the same study did not find any relationship between negative affect and academic performance.

Conclusively, research examining the relationship between emotions in studying and academic performance is consistent in finding a positive relationship between positive emotions and academic performance. The observed relationship held even when controlling for the effect of prior academic performance. With regards to negative emotions, research in general supported a negative relationship between negative emotions and academic performance. However, the negative relationship was less consistent. In all, review of the research strongly indicated that emotional valence (positive vs. negative) rather than activation, control and subject focus was the most important facet in the relationship between emotions and learning progress.

1.2.7 *Overall evaluation of the relationship between emotions and academic performance*

The four theories of emotions reviewed in this section (i.e., the control-value theory (Pekrun, 2000, 2006), the control-process theory (Carver & Scheier, 1990, 2001), the mood-as-input theory (Martin et al., 1993), and the broaden-and-build theory (Fredrickson, 1998, 2001)) are somewhat different in a way they conceptualise emotions and explain their functions. However, despite rather profound differences between

these theories, they are not mutually exclusive. On the contrary, they supplement each other and enable more comprehensive understanding of the nature and functions of emotions in education. Three general theories of emotion predominantly concentrated on the importance on emotional valence and predicted that positive affect in studying will facilitate leaning, whereas negative affect will undermine learning.

Results of the reviewed empirical research overall supported the positive relationship between positive affect and academic performance, and the negative relationship between negative affect and academic performance. Overall, general theories of emotions (the control-process theory, the broaden-and-build theory, and the mood-as-input theory) conjointly gave a better account of the effect of positive and negative emotions on learning and academic performance than the control-value theory (Pekrun, 2000, 2006).

Conclusively, research on emotions in education suggested that positive and, to a lesser extent, negative affect in studying were important correlates of learning. However, there were two key limitations common to all reviewed studies. Firstly, the negative relationship between negative affect and academic performance could be significant due to a confounder (test anxiety) of negative affect. Test anxious students were found to experience higher levels of negative affect (particularly shame and guilt) (Arkin, Detchon, & Maruyama, 1982; Stowell, Tumminaro, & Attarwala, 2008) and general trait and state anxiety were strongly correlated with

negative affect (e.g., Clark, Watson, & Mineka, 1994; Clark & Watson, 1991). As such, the effect of negative emotions on academic performance should be tested controlling for the effect of evaluation anxiety.

Secondly, prior high academic performance was associated with positive feelings and as such, positive affect can be a mere mediator in the relationship between prior academic performance and following academic performance. Therefore, the relationship between prior academic performance, positive affect and following academic performance needs further research.

1.3   Creativity in Education

Since its conceptualisation creativity took a special place in education. In the past six decades there have been several attempts to incorporate creativity in the curriculum and assessments. For instance Moyer and Wallace (1995) argued that education should be primarily concerned with the development of creativity and individuality to ensure graduates' self-actualisation and success in life. Creativity is an essential skill/ability for adaptation in a constantly changing work environment, as it enables an individual to imagine, synthesise, connect, invent and explore (Sternberg & Lubart, 1995). However, Higher Education made little progress in successfully teaching/developing students' creative skills/abilities. Partly this failure can be attributed to the elusive and

multifaceted nature of creativity phenomenon (Davis, 2004) and difficulty in measuring it (Runco & Pritzker, 2011).

Multiple conceptualisations of creativity have been proposed throughout the years. The most efficient way however is offered by *Big-C* and *little-c* theoretical frameworks (Davis, 2004). Big-C creativity (Treffinger, 1986), also known as "special talent" (Maslow, 1962) "social" (Harrington, 1990), "eminent" (Richards, 1993), "attributed" (Runco, 1995) creativity, refers to studying creativity in people who excel in their domain of the activity like artists and musicians (Csikszentmihalyi, 1997). Big-C creativity is signified by "[…] the achievement of something remarkable and new, something which transforms and changes a field of endeavour in a significant way […] the kinds of things that people do that change the world" (Feldman, Csikszentmihalyi, & Gardner, 1994, p. 1). The Big-C creative ideas "[…] are accepted by experts as being of scientific, aesthetic, social, or technological value" (Vernon, 1989, p. 94). As such, this view of creativity posits that only few individuals have innate special ability for creativity. Therefore, the Big-C creativity framework is rather restrictive in its application to education i.e., educational institutions are powerless in developing Big-C creativity.

Much less restricting is the little-c creativity framework, also known as "self-actualising" (Maslow, 1962), "private" (Harrington, 1990), "everyday" (Richards, Kinney, Benet, & Merzel, 1988), "small"

(Feldman, Csikszentmihalyi, & Gardner, 1994), "inherent" (Runco, 1995) creativity. It refers to the universal human ability for creativeness i.e., everyone is creative to some extent and can develop their creative abilities further. Research within the little-c creativity framework is predominantly concerned with how people apply their creativity to solving day-to-day problems and to overcoming obstacles (Richards et al., 1988). Importantly, in creativity research the word "problem" or "problem solving" refers to any task at hand that gives opportunities for improvement and challenges for change. As such, the little-c view of creativity offers an appropriate framework for studying creativity in education.

This dichotomy was further developed into the *four-c model of creativity* by inclusion of *mini-c* and *pro-c* creativity (for a review see Kaufman & Beghetto, 2009). However, mini-c and pro-c are seen as prerequisites for little-c creativity. The model states that an individual does not necessarily have to pass through mini-c and pro-c stages in order to reach little-c creativity stage. In its essence, this four-c model transforms the continuum of everyday creativity into stages. As such, the four-c model of creativity overall adds more complexity to the conceptualisation of creativity and little to advancing our understanding of the phenomenon.

The alternative structure to studying creativity is offered by the *four Ps* perspective on creativity. The four Ps correspond to *person,*

product, press and *process* (Davis, 2004) approaches. These approaches determine definitions, theories and methods for research on creativity.

From the *person* perspective, research is mainly concerned with identifying personality traits that promote creative behaviour. They are usually assessed using self-reported questionnaires. From the *product* perspective, creativity is defined by the creative output (i.e., product, idea, performance, etc.). Product's creativity is generally assessed/judged by a third party. From the *press* perspective, creativity research is mainly concerned with examining social and psychological environments that facilitate or undermine creativity. Finally, from the *process* perspective, creativity research is mainly concerned with studying thinking strategies/techniques that lead to being creative. Importantly, the four Ps perspectives on creativity are not mutually exclusive. On the contrary, they are interdependent in a way that a creative person in a creativity stimulating environment engages in creative process to produce a creative product.

1.3.1 Creative cognitive processes

Creative process is probably the most challenging area of creativity research and in comparison with other three Ps it is least explored. Davis (1999) highlighted that "[…] remarkably, the issues of techniques of creative thinking is scrupulously ignored in tomes that present theories of creativity, despite the fact that every creative person

uses such techniques" (p. 115). Early theories of process creativity were mainly concerned with description of the creative process stages and their sequence.

The early model of creative process was proposed by Wallas (1926), and it describes four stages. According to this four-stage model, the first stage is a preparation stage. At this stage the "problem" is defined, studied, elaborated on, and possible solutions are formulated. The second stage is an incubation stage. At this stage problem solving process moves to the subconscious thinking level. Thus, an individual is not actively solving the problem, but instead concentrates on other unrelated and mentally undemanding activities (e.g., jogging, walking, playing and sleeping). Following the incubation, the individual moves to the elimination stage. This stage is signified by the "Aha!" or "Eureka!" experience. It occurs when an idea/solution that meets the requirements of the problem suddenly surfaces to the consciousness. The final stage is a verification stage. This stage involves checking the illuminated idea, and determining its validity and appropriateness.

Torrance (1988, 1995) also proposed a four-stage model, but it differed from Wallas' (1926) one in a number of ways. Thus, in the Torrance's (1988, 1995) model, the first stage encompasses the process of defining the problem, difficulty, gap of information and missing links. The second stage describes the process of hypotheses formation where an individual makes guesses about possible ways of solving the problem.

The third stage includes process of testing proposed hypotheses. And finally, the last stage contains the process of communicating the result of the creative process. Furthermore, in contrast to Wallas' (1926) stages, all Torrance's stages describe conscious and effortful thinking about the problem. As such, Torrance's (1988, 1995) approach describes a "scientific" approach to creative problem solving.

Similar to Torrance's (1988, 1995) model is the *creative problem solving (CPS)* model (Treffinger, 1995). The CPS model was originally proposed in the 50's and developed throughout the 70's and 80's. In its final form the CPS model contains six stages of creative process: mess finding, fact finding, problem finding, idea finding, solution finding and acceptance finding. It also described stages of conscious thinking.

At the mess finding stage a person identifies the problem that needs a creative solution. At the fact finding stage the person determines what is known about the problem. At the problem finding stage the problem is finally defined. At the idea finding stage the person actively engages in generating ideas i.e., brainstorming. At the solution finding stage, the generated ideas are examined and evaluated. At the final stage (acceptance finding) the person implements the winning idea.

These six stages can be grouped into three higher order stages: identifying the problem, generating ideas, and planning for action. The CPS model provides the most detailed account of the creative process and it gives guidance on what should be done at each stage and in what

sequence in order to come up with the creative solution/idea (Treffinger, 1995). Therefore, the CPS model is the most widely used in creativity training programmes.

The main limitation of these process models is that they fail to adequately account for thinking strategies taking place at each stage. The *creative cognition* approach to studying creativity addresses this limitation of the process models. The creative cognition framework successfully combines the cognitive psychology research tradition with scientific understanding of creativity. The main aim of the creative cognition research is to identify which cognitive processes lead to being creative or not being creative (Ward, 2007; Ward, Smith, & Finke, 1999). As such, this approach concentrates on examining creative thinking processes rather than stages of a creative process.

However, despite the differences in the research focus between the creative process framework and the creative cognition framework, they overlap. Thus, both frameworks appreciate that creativity is an outcome of certain thinking/cognitive processes, and that creative cognitive processing occurs in stages i.e., each stage is dominated by a particular cognitive strategy.

Ebert (1994) proposed probably the most simple and inclusive definition of creative thinking as "[…] a characteristic of cognitive processing, [that] is an attribute possessed by all who think" (p. 288). This implies that anyone can be creative and that the difference between

individuals in creativity levels is just a function of differences in cognition i.e., the extent to which each individual engages in creative cognitive processing. This view was widely accepted and shared by researchers studying creative cognitive processes e.g., Garnham and Oakhill (1994), Ward, Smith and Finke (1999), Weisberg (1986, 1999).

The most researched processes are divergent and convergent thinking, metaphorical and analogical thinking, perspective taking, imagery and incubation (Davis, 2004). Divergent thinking is the process of generating as many as possible alternative ideas or solutions to a problem, whereas convergent thinking is the process of evaluating the adequacy and usefulness of ideas, and identifying and selecting the best idea for future action (Campbell, 1960; Cropley, 1999, 2006). Metaphorical/analogical thinking is the process of idea combination, transformation, and application. Metaphorical/analogical thinking involves taking an already existing idea from one context and applying it in a new one, or combining previously unrelated ideas to come up with the new idea (e.g., Arieti, 1976; Dreistadt, 1968; Gordon, 1973). Perspective taking is the process of changing one's own perspective to enable perceptual transformation i.e., change in perception to gain a novel insight into the problem at hand that leads to a new meaning (Davis, 2004). Imagery is the process of constructing internal images, and is regarded as a fundamental element of the creative process (Daniels-

McGhee & Davis, 1994) together with other forms of sensory modality like hearing and smell (Morris & Hampson, 1983).

Importantly, all the described cognitive processes associated with creativity are conscious. This distinction implies that these cognitive processes or thinking strategies can be taught and developed. Opposite to conscious thinking strategies is incubation, also known as "insight". Wallas (1926) defined incubation as a non-voluntary or conscious thinking about the possible solution to a problem, which brings a person closer to finding a suitable resolution. Thus, incubation has a lower level of consciousness (Ward et al., 1999) and as such, it is different to other thinking strategies in its susceptibility to teaching and development.

Nevertheless, all the above-mentioned creative thinking processes are common across all areas of creative activity. They are affected by subjective experiences, abilities, strategies, environment and problem-specific constrains (Davis, 1999). As such, within an education context, the creative cognition framework provides valuable insights into understanding how creativity affects learning, and also offers a way of somewhat addressing the paralysing problem of developing creativity in students. Incubation is probably the hardest thinking strategy to teach/develop, because people cannot voluntarily engage in incubation in the same way as they can for example engage in divergent or convergent thinking. Nevertheless, the study environment can be structured in a way that fosters students to enter an incubation stage when studying.

1.3.2 Creativity and academic performance

In their majority, scholars studying creativity are in consensus that it is an essential skill/ability for life success and individual growth and as such, argue that the development of creativity should be one of the primary concerns for education. However, despite the fascinating possibility of the creative ability to improve overall life success probability, there are only few studies that looked at the relationship between creativity and learning progress. Creativity is a multidimensional and multifaceted construct. Therefore, when researching its relationship with learning, particular attention should be paid to the way creativity and academic performance were measured. It is important to highlight that the majority of the research on students' creativity and academic performance in Higher Education was done in so called "developing countries" (e.g., Iran, Pakistan) with only few studies conducted in United Kingdom and United States. Therefore, due to the differences in educational systems, curricula and assessments, findings of those studies have limited applicability to the UK Higher Education.

Naderi, Abdullah, Aizan, Sharir and Kumar (2009) examined the effect of creativity, age and gender on academic performance in a sample of 153 Iranian undergraduate students studying in Malaysia. The creativity in this study was measured using *Khatena-Torrance Creative Perception Inventory* (Khatena, 1977). This inventory is a self-reported

autobiographical measure of creativity designed to capture individuals' perception of creative self. The measure consists of questions assessing two core perceptions: *What kind of a person are you?* and *Something about myself?* The questions in the inventory are designed in such a way, that responses allow determining whether an individual has a predisposition to behave in a creative way. This measure assesses creativity from a *person* perspective i.e., measures creative personality.

Students' academic performance in this study was recorded as an overall GPA grade for all the subjects taken in that semester. The authors refrained from describing the types of assessments used (e.g., coursework, essay-type examination, multiple-choice tests) and therefore, it is hard to determine whether there was an opportunity for students to be creative. The opportunity for creativity in assessments could largely affect the strength of the relationship between creativity and academic performance.

The overall result showed that creativity was a rather weak correlate of academic performance (Naderi et al., 2009) and that the relationship was stronger for females than males (Naderi, Abdullah, Tengku Abd Hamid, Sharir, & Vijay, 2010). In addition to the earlier outlined limitations that impair the interpretation of the results, the information about the students' course of study and level of a degree was also omitted. The course subject as well as the degree level could further explain weak correlation between creativity and academic performance

e.g., students in creative disciplines or students in non-creative disciplines.

Research also examined the relationship between creativity and academic performance in a sample of 272 Iranian undergraduate students who majored in English (Pishghadam, Khodadady, & Zabihi, 2011). The creativity was measured using *Arjomand Creativity Questionnaire (*ACQ; Arjomand, 2003, cited in Pishghadam, Khodadady, & Zabihi, 2011). This scale is also a self-reported measure of creativity that was developed in Iran. In this study the authors refrained from adequately describing the used questionnaire and therefore, it was impossible to determine what facets of creativity were assessed.

Students' academic performance was measured as an overall GPA. The results indicated that there was overall a positive relationship between creativity and academic performance. Furthermore, the results indicated that high achievers were significantly higher on their overall level of creativity than mid and low achievers. Despite the encouraging results of this study, failure to define what facet of creativity was assessed leaves the relationship between creativity and academic performance elusive and hard to interpret.

A different approach to studying the relationship between creativity and academic performance was employed by Atkinson (2004). Atkinson (2004) looked at the difference in teacher-rated creativity of students between high and low achievers. This study used a sample of UK

university students. In total, 54 Initial Teacher Training (ITT) Design and Technology degree students participated in this research.

A module tutor rated the creativeness of each student on a scale from 1 (low creativity level) to 4 (high creativity level). The majority of students were rated as non-creative (36 vs. 18). Students' academic performance was measured as an overall grade and expressed in percentage points on a yearlong design project. The mean of academic performance for the whole sample was 58%. Atkinson (2004) found that the academic performance mean in the high creativity group was higher than in the low-creativity group. Based on that observation Atkinson (2004) concluded that there was a positive relationship between creativity and academic performance.

However, this conclusion is an overestimation of the actual findings. The relationship between creativity and academic performance was not tested adequately (i.e., correlations). Therefore, the author's conclusion that there is a relationship between the two constructs is inadequate. The results were only indicative of possible differences between creative and non-creative students in their academic performance.

Furthermore, it is unclear whether the person who rated students' creativity was the same person who assessed their coursework. This information is crucial for determining the interpretation of research results and identifying biases. It was also unclear what criteria were used

to rate students' creativity, which is essential for understanding what facet of creativity was investigated in relation to academic performance.

In all, failure to provide the key information necessary for interpreting this study's results impedes understanding of the role creativity plays in studying. Overall, with a degree of guessing, the three studies reviewed so far looked mainly at creativity from the *person* perspective. Their results overall were inconclusive in whether creative students were better at studying and achieved higher academic performance.

To further understand the relationship between creativity and academic performance research also looked at the effect of creative cognition on learning. In relation to academic performance the most researched creative cognitive strategy was divergent thinking, and in general it was used synonymously with creative thinking. Divergent thinking was usually measured along four dimensions: fluency (ability to produce quantities of ideas), originality (ability to produce new, uncommon, unique ideas), elaboration (ability to embellish ideas assessed by assessing level of detail), and flexibility (ability to process information or objects in different ways).

Chamorro-Premuzic (2006) examined longitudinally the relationship between creative thinking and academic performance in a sample of 307 UK undergraduate students. Creative thinking was assessed using *Alternate Uses Test* (Christensen et al., 1960). This test

required participants to name as many alternative uses for a common object (e.g., brick, paperclip) as they can. The responses were scored along five dimensions: fluency (number of responses), originality (new, uncommon, unique ideas), elaboration (level of detail), flexibility (quantity of categorically different answers), and appropriateness (usefulness/quality of ideas). The overall score on this task indicated the average creativity level. As such, this test indirectly assessed these students' capability to think creatively: divergent thinking (fluency), convergent thinking (appropriateness), and analogical thinking (flexibility). The students' academic performance on examinations, continuous assessments and dissertation was recorded for four consecutive years.

The results of the correlation analysis showed that creative thinking positively correlated with examination and dissertation scores but did not correlate with continuous assessment scores. Further analysis also showed that creative thinking negatively correlated with the individuals' preferences for examination and continuous assessment and positively correlated with the individuals' preferences for group work and final year dissertation. Overall, this study provided solid evidence for the effect of creative thinking on learning and academic performance.

The effect of creative thinking on academic performance was also examined by Wang (2011). However, in contrast to Chamorro-Premuzic (2006), Wang (2011) looked at the relationship between creative thinking

and prior academic performance in samples of 125 Taiwanese and 133 American (US) undergraduate degree students, who studied for teacher qualifications.

Creativity was assessed using *Abbreviated Torrance Test for Adults (ATTA*; Goff & Torrance, 2002). This test is a short version of *Torrance Test of Creative Thinking (TTCT*; Torrance, 1998), which assesses an individual's creative thinking on four key dimensions: fluency (ability to produce quantities of ideas), originality (ability to produce new, uncommon, unique ideas), elaboration (ability to embellish ideas), and flexibility (ability to process information or objects in different ways). As such, the ATTA measures the same facets of creativity as Alternate Uses Test used in Chamorro-Premuzic's (2006) study. The prior academic performance of US students was assessed through California Basic Educational Skills Test (CBEST) scores, which comprised of writing, reading and mathematics scores. The academic performance of Taiwanese students was assessed through College Entrance Academic Ability Test (CEAAT), which comprised of Chinese, English, mathematics, science, and history scores.

The results showed that in both student samples prior academic performance accounted for 10% of variance in creative thinking in the US sample and 18% of variance in creative thinking in the Taiwanese sample. Overall, the results of Wang's (2011) study indicated that prior academic

performance facilitated creative thinking (divergent thinking) in students regardless of culture and gender.

The less convincing results were obtained by Khamsé (2006). The creativity in this study was measured using *Creativity Test (CT*; Auzmendi, Villa, & Abedi, 1996). Creativity Test (CT) is a self-reported questionnaire that assesses an individual's fluency, flexibility, originality, and elaboration in problem solving (i.e., assesses thinking and behavioural strategies leading to creativity). The sample used in this study comprised of 3770 undergraduate students from six universities across Iran. Students in this sample predominantly studied science subjects, technology and engineering, and only 35 students majored in Arts. Students' academic performance was measured as an overall prior academic performance.

Overall, a weak positive relationship was observed between the self-reported use of creative thinking and prior academic performance (r = .1). However, the relationship was so weak, that it was significant entirely due to the large sample size. This indicates that creativity measured by CT is largely unrelated to students' academic performance.

The same measure of creativity was used by Ghayas, Akhter and Adil (2012). They looked at the difference in creativity levels between low and high academic achievers (n=154 undergraduate Pakistani students). Based on prior academic performance (cumulative GPA), students were assigned either to high and low achievers groups. The t-test

results supported an overall significant difference between the two groups. Thus, students in the high achievers group on average scored higher on the self-reported use of creative thinking in problem solving, than students in the low achievers group. However, the difference was found only on the originality of ideas and not on other properties of creative ideas i.e., flexibility, elaboration and fluency. Importantly, there was no difference in creative thinking between students who majored in arts and social sciences, and students who studied "pure" sciences (i.e., physics, chemistry, mathematics).

Further research aiming to examine the relationship between creativity and academic performance used a sample of 235 final year Business Administration students from Nigerian Universities (Olatoye, Akintunde, & Yakasai, 2010). Students' creativity was measured using *Nicolas Holt Creativity Test (NHCT),* which is a self-reported questionnaire assessing properties of situations that facilitate students' creative thinking as well as creative behaviours and thinking strategies. GPA was used as a measure of students' academic performance. Overall, creativity in this study failed to explain students' academic performance.

The authors attributed the lack of a relationship between creativity and academic performance to the nature of the curriculum and assessments. The curriculum in the participating university was heavily oriented towards delivery of knowledge, and assessments were designed

to assess memory. As such, students were given limited opportunity to express and develop their creativity (engage in creative thinking).

Similar results were also obtained by Tatlah, Aslam, Ali and Iqbal (2012). They also used NHCT to assess creativity (n=235 business students). Taking into consideration that the last two studies used the same creativity measure and both failed to find a relationship between creativity and academic performance, this failure can be partially attributed to the poor predictive validity of NHCT.

1.3.3   Overall evaluation of the relationship between creativity and learning, and academic performance

The review of the creativity concept indicated that within Higher Education creativity is best researched from the little-c perspective, as it defines creativity as a universal human characteristic. Furthermore, the creative cognition approach was identified as an appropriate research framework for studying the relationship between creativity and academic performance. Within the creative cognition approach creativity is researched from a process perspective and the main aim is to identify which thinking strategies/processes lead to being creative. Creative thinking strategies leading to creativity are divergent and convergent thinking, metaphorical and analogical thinking, perspective taking, visualisation and incubation.

The research examining the relationship between creativity and academic performance was mainly looking at the relationship between divergent thinking and GPA. The research findings overall were inconsistent from study to study. As such, it is still unclear if creative ability or creative cognition facilitates learning and higher academic performance.

Importantly, none of the reviewed studies looked at the use of creative thinking as a context-dependent behaviour i.e., creative thinking in studying. According to the creative cognition approach, creative thinking is a characteristic of everyone who thinks, implying that the actual use of creative thinking in studying is, therefore, more important than the creative ability per se. Thus, creative ability and the 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 study contexts, whereas some people low in creative ability do. Therefore, based on the literature review it is proposed that it is the frequency of use of creative cognition in a context – rather than creative ability per se – that is important in studying and should relate to better learning and higher academic performance.

There are a number of standardised tests measuring creative ability – such as the Torrance Test of Creative Thinking (TTCT;

Torrance, 1998) and the Creativity Assessment Pack (CAP; Fekken, 1985) – there is a paucity of self-reported scales measuring students' ability and/or willingness/habit to deploy their creative cognition to studying. Having a valid and reliable measure of such a virtuous habit would be useful for both researchers and teachers for monitoring students' use of creative cognition, and evaluating an effect of interventions aimed at fostering students' creative thinking in studying.

Two self-reported measures have been developed so far to assess cognitive processes associated with creativity. The Creativity Styles Questionnaire – Revised (CSQ-R; Kumar, Kemmler, & Holman, 1997) is a 78-item questionnaire that assesses the use of and beliefs about cognitive processes associated with creativity (i.e., use of senses, use of techniques, beliefs in unconscious processes) in addition to assessing several other facets of creativity (i.e., person, product, press). The Cognitive Processes Associated with Creativity scale (CPAC; Miller, 2009) is a 28-item measure that taps more specifically the beliefs about and use of cognitive processes associated with creativity. However, these scales have shortcomings. The CSQ-R scale does not assess all of the cognitive processes associated with creativity, whereas the CPAC scale has problems with construct validity and reliability of its subscales. As such, there is an apparent need for a short and direct measure assessing the frequency of use of creative thinking strategies in studying. Having an adequate measure assessing deployment of creative cognition in studying

would then enable investigations into the relationship between the use of creative thinking and academic performance.

1.4   Main Research Objectives

Current literature review identified several gaps in the research examining the effect of three key psychological correlates of learning (i.e., approaches to studying, positive and negative affect and creativity) on students' academic performance in Higher Education. Approaches to studying overall were proposed to be important factors for learning. However they were inconsistent in their relationship with students' academic performance.

Out of eight studies that examined the effect of approaches to studying on academic performance (when controlling for the effect of prior academic performance) only few found that approaches to studying accounted for a significant portion of variance. However, in these studies approaches to studying remained significant correlates of academic performance mainly due to a large random error in measures of prior and following academic performance (e.g., controlling for the effect of prior school GPA in the relationship between approaches to studying and university examination performance). Therefore, to more accurately estimate the variance approaches to studying account for in learning, future research should aim to reduce the effect of random error in

measures of prior and following academic performance (e.g., a past semester examination and a current semester examination).

Emotions were also identified as an important correlate of learning. However, there are only few studies that looked at the effect of emotions on academic performance, and the majority of those studies only looked at the effect of achievement emotions. The review of the research and theories of emotions overall suggested that emotional valence is the strongest correlate of learning progress and that non-achievement emotions are also important in learning. The review of the empirical studies in its majority supported the positive relationship between positive emotions and the negative relationship between negative emotions and academic performance. However, the research in the area of emotions in education is rather limited and further studies are needed to verify the observed relationships.

Taking into an account that both cognitive-behavioural tendencies (approaches to studying) and dispositional emotional experience (affect in studying) can explain academic performance, Trigwell, Ellis and Han (2012) tested their effects of academic performance simultaneously in a sample of 388 undergraduate students. As expected, positive emotions explained better academic performance and the surface approach to studying explained poorer academic performance; whereas negative emotions and the deep approach to studying failed to explain students' academic performance.

These results however should be considered in light of three key methodological limitations. Firstly, the R-SPQ-2F was used to measure deep and surface approaches to studying, which has a poor predictive validity. Secondly, in this study only the effect of achievement emotions was examined. Thirdly, prior academic performance was not controlled for, which is necessary for estimating the proportion of variance approaches to studying and emotions account for. As such, further research is needed to address these limitations, and to identify whether emotional or cognitive-behavioural variables are better at explaining learning and academic performance.

Creativity was also identified as an important correlate of learning. However, there is a paucity of research examining the effect of creativity on learning. Following the review of the creativity theory and creativity research in education, it became evident that it is an individual's tendency to deploy one's own creative cognition in studying that is important for learning and academic performance, rather than creative ability per se. However, up to date, no one has examined the relationship between creativity and learning from this perspective. Partly this could be due to a scarcity of creativity scales that would adequately measure students' tendency to use creative cognition in an endeavour. Therefore, future studies need to firstly, design/develop a measure capturing the frequency of use of creative cognition; and secondly

examine the relationship between students' use of creative cognition and learning progress/academic performance.

The current literature review only covered three core psychological correlates of learning, and examined empirical evidence for their effect on academic performance. This review therefore provided a necessary framework for designing the first three studies of this Ph.D. research. However, as the research progresses towards the development of the model of academic performance, more psychological factors that affect learning will be reviewed in their relationship with learning and academic performance. The aims and hypotheses for this research are specific to each study and as such, are presented in relevant chapters.

CHAPTER 2 – STUDY 1

Academic Performance as a Function of Approaches to Studying and Affect in Studying

Abstract

Based on the SAL theory and reviewed theories of emotions, it was hypothesised that students' deep and strategic approaches to studying and positive affect in studying would positively correlate with academic performance, whereas students' surface approach to studying and negative affect in studying would negatively correlate with academic performance. A sample of 406 undergraduate students completed the Approaches and Study Skills Inventory for Students *(ASSIST)*, the International Positive and Negative Affect Schedule – Sort Form *(I-PANAS-SF)*, and the Evaluation Anxiety Scale (*EVAN*), and their end-of-semester and prior semester academic performance were recorded. Regression analyses controlling for prior semester academic performance and evaluation anxiety firstly showed that positive affect explained better academic performance. Secondly, that negative affect measured in the second half of a semester explained poorer examination grades and Grade Point Average. And finally that approaches to studying failed to explain all measures of academic performance.

2.1   Introduction

Intellectual ability (e.g., Gottfredson, 2002, 2003; Neisser et al., 1996) and previous academic performance (e.g., Busato, Prins, Elshout, & Hamaker, 2000; Salanova, Schaufeli, Martinez, & Breso, 2010; Zeegers, 2004) are considered to be the strongest correlates of success in Higher Education. Therefore, the present study examines effects of approaches to studying and positive and negative affect in studying on students' academic performance, statistically controlling for the effect of compatible prior academic performance and evaluation anxiety (which is a potential confounder of negative affect).

The results of previous empirical research examining the relationship between approaches to studying and academic performance were inconclusive. Some studies found a meaningful relationship between approaches to studying and academic performance (Byrne et al., 2002; Diseth et al., 2010, 2006), whereas others failed to do so (Cassidy & Eachus, 2000; Diseth & Martinsen, 2003; Reid et al., 2007). However, the average correlation coefficients calculated for all reviewed studies indicated that there was a positive relationship between deep and strategic approaches to studying, and a negative relationship between the surface approach to studying, and academic performance (Chapter 1). Therefore it was hypothesised that:

H 1.1   *(a) Deep and strategic approaches to studying will be positively associated with academic performance, whereas (b) the surface approach to studying will be negatively associated with academic performance.*

Studies examining the relationship between emotions in studying and academic performance were more consistent in their findings than studies examining the effect of approaches to studying on academic performance. Overall, positive emotions correlated with higher academic performance, whereas negative emotions correlated with lower academic performance (e.g., Artino, Holmboe, & Durning, 2012; Pekrun et al., 2011; Saklofske et al., 2012).

The review of the four theories of emotions applicable in educational settings revealed that general theories of emotions (i.e., the *control-process* theory (Carver & Scheier, 1990, 2001), and the *broaden-and-build* theory (Fredrickson, 1998, 2001)), conjointly gave a better account for the effect emotions have on learning than the *control-value* theory (Pekrun, 2000, 2006). This study therefore took the perspective of the control-process model of self-regulation of intentional behaviour (Carver & Scheier, 1990, 2000) and the broaden-and-build model of positive emotions (Fredrickson, 1998, 2001) to examine the relationship between positive and negative affect and academic performance. Both theories predict that positive affect would relate to better learning,

whereas negative affect would relate to poorer learning. Therefore it was hypothesised that:

H 1.2   (a) Positive affect in studying will be positively associated with academic performance, whereas (b) negative affect in studying will be negatively associated with academic performance.

The control-process theory postulates that positive affect indicates a faster than desired rate of progress towards the goal, or simply, discrepancy reduction between current and desired states. As such, the experience of high levels of positive affect results in temporary "coasting", which is a way of slowing down the progress and putting oneself closer to the reference value. Coasting continues until the reference value becomes more ambitious.

On the other hand, negative affect indicates a slower than anticipated rate of discrepancy reduction. As such, the experience of high levels of negative affect results in extra effort put towards studying, which is a way of reducing the discrepancy between current and desired rate of progress. Over-effort continues until the reference value becomes more modest. If recalibration of the reference value is not possible, it may eventually result in withdrawal and goal abandonment.

Therefore, based on the control-process model, students' experience of positive affect in the first half of a semester indicates that

learning progress is faster than desired and may lead a student to reduce effort and engage in coasting. If coasting occurs, positive affect in the second half of a semester may represent contentment with prior learning progress rather than emotions signalling current learning progress. In turn, coasting can weaken the relationship between positive affect and academic performance in the second half of a semester. Therefore, it was hypothesised that:

H 1.3   Semester phase will moderate the positive association between positive affect in studying and academic performance in such a way that the association will be stronger for positive affect measured in the first half of a semester.

On the other hand, students' experience of negative affect in studying indicates insufficient learning progress. Negative affect therefore should become a better indicator of insufficient learning progress as a student exerts greater effort in learning. Students typically put more effort into studying as the end of a semester approaches, and insofar as progress is not made despite the increased effort, negative affect will become a more valid signal of poor learning progress. In turn, increased effort can strengthen the relationship between negative affect and academic performance in the second half of a semester. Therefore, it was hypothesised that:

H 1.4   *Semester phase will moderate the negative association between negative affect in studying and academic performance in such a way that the association will be stronger if negative affect is measured in the second half of a semester.*

2.2   Method

2.2.1   Participants

An opportunity sample of 500 students from a London University was invited to take part in this study. The response rate in total (Time 1 and Time 2) was 81.2%, resulting in a final sample of 406 students. Every student who consented to take part in this research had fully completed the questionnaire and there were no incomplete questionnaires. Therefore, it is possible to conclude that students who did not respond were simply not interested in taking part in this study. Participants' demographic characteristics for Time 1 and Time 2 sub-samples are summarised in Table 6.

The Time 1 sub-sample consisted of 185 students of whom 48 (25.9%) were males and 137 (74.1%) were females, with age ranging from 18 to 51 ($M = 24.3$, $SD = 6.1$). Seventy-eight (42.2%) participants were from the Faculty of Life Science, 62 (33.5%) were from the Business School, 27 (14.6%) were from the Faculty of Social Science and Humanities, 7 (3.8%) were from the Faculty of Law and International Relations, and 11 (5.9%) withheld that information.

Table 6: *Summary of Participants' Demographic Characteristics for*
     Time 1 and Time 2 Sub-samples (Study 1).

	Time 1 sub-sample		Time 2 sub-sample	
Variable	*N*	*%*	*N*	*%*
Gender				
Male	48	25.9	48	21.7
Female	137	74.1	173	78.3
Faculty				
Life Science	78	42.2	71	32.2
Business School	62	33.5	40	18.1
Social Science and Humanities	27	14.6	72	32.5
Law and International Relations	7	3.8	18	8.2
Unknown	11	5.9	20	9
Degree level				
Foundation	1	0.5	16	7.2
1st year	84	45.5	59	26.7
2nd year	45	24.3	53	24
3rd year	26	14.1	47	21.3
Postgraduate	29	15.6	46	20.8
Ethnicity				
White	101	54.6	122	55.2
Black	28	15.1	31	14
Asian	13	7.1	12	5.4
Mixed	10	5.3	12	5.4
Other	26	14.1	35	15.8
Unknown	7	3.8	9	4.2
Nationality				
British	82	44.3	96	43.4
Non-British	99	53.5	118	53.4
Unknown	4	2.2	7	3.2

Students were also enrolled in different levels of their degree programme:

1 (0.5%) was foundation degree student, 84 (45.5%) were first year

undergraduate students, 45 (24.3%) were second year undergraduate

students, 26 (14.1%) were third year undergraduate students, 29 (15.6%)

were postgraduate degree students. There were 101 (54.6%) Whites, 28

(15.1%) Blacks, 13 (7.1%) Asians, 10 (5.3%) participants of mixed ethnicity, 26 (14.1%) participants from other ethnic backgrounds, and 7 (3.8%) participants who withheld information about their ethnicity. There were 82 (44.3%) British participants, 99 (53.5%) non-British participants, and 4 (2.2%) participants who did not report their nationality.

The Time 2 sub-sample consisted of 221 students of whom 48 (21.7%) were males and 173 (78.3%) were females, with age ranging from 18 to 62 ($M = 27.7$, $SD = 9.2$). Seventy-one (32.2%) participants were from the Faculty of Life Science, 40 (18.1%) were from the Business School, 72 (32.5%) were from the Faculty of Social Science and Humanities, 18 (8.2%) were from the Faculty of Law and International Relations, and 20 (9%) withheld that information. Students were also enrolled in different levels of their degree programme: 16 (7.2%) were foundation degree students, 59 (26.7%) were first year undergraduate students, 53 (24%) were second year undergraduate students, 47 (21.3%) were third year undergraduate students, 46 (20.8%) were postgraduate degree students. There were 122 (55.2%) Whites, 31 (14%) Blacks, 12 (5.4%) Asians, 12 (5.4%) participants of mixed ethnicity, 35 (15.8%) participants from other ethnic backgrounds, and 9 (4.2%) participants who withheld information about their ethnicity. There were 96 (43.4%) British participants, 118 (53.4%) non-British participants, and 7 (3.2%) participants who did not report their nationality.

The Time 1 and Time 2 sub-samples had distributions of background variables that are consistent with the international and ethnically diverse composition of the overall university's study population, and are in line with the profiles identified in previous studies (e.g., Moneta, Spada, & Rost, 2007; Moneta, Vulpe, & Rogaten, 2012; Moneta & Spada, 2009). Moreover, the results of a series of t-tests showed no mean difference between the Time 1 and Time 2 sub-samples in any of the study variables (i.e., approaches to studying, affect in studying, evaluation anxiety, and prior semester academic performance). Finally, the mean differences in the study variables between sub-samples identifiable based on key background variables were examined. There was no mean difference in any of the study variables between participants from different Faculties and year levels, between British and non-British participants, and between White and non-White participants, with two exceptions: non-British participants and non-White participants reported higher negative affect in studying than British participants and White participants, respectively, did (British: $M = 2.0$, $SD = .8$; non-British: $M = 2.2$, $SD = .9$; t = -3.002, $p < .01$; White: $M = 2.0$, $SD = .8$; non-White: $M = 2.2$, $SD = .9$; t = -2.438, $p < .05$).

2.2.2 Measures

Approaches and Study Skills Inventory for Students (ASSIST), Short 18-Item Form (Entwistle, 2008) is a self-reported questionnaire

with six questions measuring each of the three domains of approaches to studying: deep (e.g., "When I'm working on a new topic, I try to see in my own mind how all the ideas fit together"), strategic (e.g., "I put a lot of effort into studying because I'm determined to do well"), and surface (e.g., "I concentrate on learning just those bits of information I have to know to pass"). The instructions used in this study were: *"Please work through the following comments, giving your immediate response. In deciding your answers, think in terms of your current experience and behaviour when you engage in study activities, and choose one appropriate number according to the following scale"*. Responses were recorded on a 4-point scale ranging from 1 (*Disagree*) to 4 (*Agree*). The scores for each scale were calculated by averaging the scores of their constituent items. The internal consistency of subscales in previous studies using similar student sample ranged from .67 to .76 (Moneta & Spada, 2009).

International Positive and Negative Affect Schedule - Short Form (I-PANAS-SF; Thompson, 2007) is a list of ten adjectives, five measuring positive affect (e.g., "Attentive") and five measuring negative affect (e.g., "Nervous"). The I-PANAS-SF was derived from the PANAS (Watson et al., 1988), and has retained only unambiguous items and items that can be clearly and uniformly understood by non-native English speakers (Thomson, 2007). The instructions used in this study were: "Please read the following adjectives in detail and think if you have those feelings.

Please respond thinking of your current experience and behaviour when you engage in study activities". Adjectives were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The scores for each scale were calculated by averaging the scores of their constituent items. The I-PANAS-SF scores correlated strongly with the PANAS scores, and subscales of positive and negative affect showed good 8-week test-retest reliabilities .84 (for both scales), and the good internal consistency of .74 for negative affect and .80 for positive affect (Thompson, 2007).

Evaluation Anxiety Scale (EVAN; Thompson & Dinnel, 2001) is a 15-item self-reported questionnaire measuring students' levels of evaluation anxiety (e.g., "I get anxious just prior to receiving the result of a test on which I was not certain of my performance"). The instructions used in this study were: "Please read each of the statement below carefully, assessing the extent to which each statement applies to your current experience and behaviour when you engage in study activities. By referring to the scale for each item, select the number that corresponds to your choice". Responses were recorded on a 7-point scale ranging from 1 *(Not at all true of me)* to 7 *(Very true of me)*. Scale scores were calculated by averaging its items. The internal consistency of the scale was .85 (Thompson & Dinnel, 2001).

Students' Academic Performance was recorded from the university database. Consistent with the participating university's assessment scheme, all students in this study had their examinations at the

end of a semester (semester weeks 13-15 are examination weeks), and all coursework submissions took place from week 6 up to week 12 of a semester (weeks 1-12 are formal teaching weeks). Students' grades expressed in percentage points (with 40% representing the minimum passing grade) were retrieved from the university database for the current and previous semesters [5]. Individual examination grades and individual coursework grades were separately identified for each participant. Student's semester average was calculated separately for each of the two types of grades across all subjects taken in that semester. Moreover, the overall performance in a semester was calculated as the Grade Point Average (GPA), which averaged grades from individual examinations, coursework, and presentations as well as group coursework and group presentations.

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[5] The prior academic performance of first year undergraduate degree students' was calculated on either grades that they obtained in their foundation degree (if they took part in this study during the first semester of their undergraduate degree) or 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 their undergraduate degree). Foundation degree students' were all in the second semester of their foundation degree, and hence the grades from the first semester of their foundation degree were used as a measure of their prior academic performance.

2.2.3   Procedure

Ethics approval for the study was obtained from a university ethics board. The questionnaire data was collected using online survey tool "SurveyMonkey" throughout the autumn and spring semesters of an academic year. Each semester comprised of twelve formal teaching weeks, followed by three weeks of examination. In each semester data collection took place only during the twelve formal teaching weeks i.e., from week 1 to week 12. The invitation letter explaining research aims and instruction for taking part in the study was sent to students' university e-mail addresses. The letter also provided the hyperlink to the online survey.

Participants' academic performance records were retrieved from the university database and synchronised with their self-reported questionnaire responses. All participants provided informed consent and authorised the researcher to link their data. Following the synchronisation process, the data for each participant was anonymised and pulled together with the data from other participants prior to data analysis. Raw performance data and questionnaire responses were stored in accordance with the Data Protection Act (1998) and were not used in data analysis. Following data collection, participants were divided into those who participated in weeks 1 to 6 of a semester (Time 1) and those who participated in weeks 7-12 of a semester (Time 2).

2.2.4   Data analysis

Research hypotheses were tested using hierarchical regression, in which end-of-semester academic performance was the dependent variable, prior semester academic performance and evaluation anxiety were the control variables, and approaches to studying and affect were the focal predictors. The regression models were fitted separately on examination grades, coursework grades, and GPA. For each of these models the corresponding prior semester academic performance was used as control variable (e.g., prior semester examination performance was the control variable for the model of end-of-semester examination performance).

In two-step hierarchical regressions, the models were fitted separately on the data of the Time 1 sub-sample and the Time 2 sub-sample. The control variables were entered as first block, and the focal predictors were entered as second block. This provided a test of hypotheses 1.1 and 1.2, and a preliminary test of hypotheses 1.3 and 1.4.

In three-step hierarchical regressions, the models were fitted on the data of the whole study sample. The control variables were entered as first block, the focal predictors were entered as second block together with semester phase (which was coded as 0 for the first half of a semester and 1 for the second half), and the interactions of positive affect and negative affect with semester phase were entered as third block. This provided a formal test of hypotheses 1.3 and 1.4.

Mediation analysis was carried out to examine whether positive affect in studying was a mediator between prior semester academic performance and current semester academic performance. In these analyses academic performance was the dependent variable, prior academic performance was the independent variable, positive affect was the mediator, and all other study variables of the second step in the hierarchical regression model (i.e., semester phase, deep, strategic and surface approaches to studying, negative affect and evaluation anxiety) were entered as covariates of the independent variable. The mediation model was estimated in SPSS using Hayes (n.d.) *PROCESS* macro (model 4), which provided bootstrap estimates with bias-corrected confidence intervals of the indirect effects. An indirect effect is significant if zero is outside of the confidence interval for that indirect effect.

2.3   Results

2.3.1   Descriptive statistics

Descriptive statistics of the study variables for the Time 1 sub-sample (for which the self-reported variables were measured in the first half of a semester) and Time 2 sub-sample (for which the self-reported variables were measured in the second half of a semester) are presented in Table 7. Cronbach's alpha exceeded the .70 acceptable standard for all variables except the surface approach to studying.

Table 7: *Means, Standard Deviations, Cronbach's alpha (in parentheses) and Correlation Coefficients of variables in the Time 1 sub-sample (below the diagonal) and in the Time 2 sub-sample (above the diagonal) (Study1).*

Variable	X	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	X	SD
Academic Performance																
1. Examination Grades	56.1	17.5	(-)	.65**	.89**	.62**	.39**	.57**	.13*	.34**	-.39**	.21**	-.38**	-.23**	59.2	16.9
2. Coursework Grades	59.0	14.2	.64**	(-)	.88**	.42**	.59**	.63**	.16*	.34**	-.28**	.18*	-.28**	-.12*	60.6	12.2
3. Grade Point Average (GPA)	58.1	13.9	.83**	.91**	(-)	.60**	.57**	.66**	.13*	.34**	-.33**	.20**	-.34**	1.17**	59.9	13.5
Prior Academic Performance																
4. Examination Grades	54.8	18.6	.57**	.55**	.57**	(-)	.57**	.83**	.05	.15	-.29**	.29**	-.29**	-.30**	57.2	15.1
5. Coursework Grades	60.2	10.7	.58**	.59**	.61**	.50**	(-)	.83**	.15	.19*	-.19*	.19*	-.16*	-.23**	61.5	9.7
6. Grade Point Average (GPA)	57.8	10.7	.66**	.67**	.72**	.83**	.75**	(-)	.14	.26**	-.27**	.28**	-.23**	-.24**	59.4	10.6
Approaches to studying																
7. Deep	3.0	.5	-.05	-.04	-.06	-.12	.07	-.04	(.74\.71)	.48**	-.15*	.38**	-.02	-.10	3.1	.5
8. Strategic	3.0	.6	.28**	.22**	.26**	.17*	.16*	.23**	.52**	(.81\.79)	-.38**	.48**	-.27**	-.25**	3.1	.6
9. Surface	2.3	.6	-.13	-.21**	-.23**	-.23**	-.21**	-.24**	-.17*	-.32**	(.69\.66)	-.29**	.45**	.35**	2.3	.6
Affect in Studying																
10. Positive Affect	3.7	.8	.30**	.34**	.35**	.11	.22**	.24**	.27**	.59**	-.35**	(.85\.80)	-.15**	-.18**	3.7	.7
11. Negative Affect	2.1	.9	-.09	-.05	-.06	-.12	-.07	-.05	-.22**	-.25**	.46**	-.14*	(.82\.79)	.49**	2.1	.7
Evaluation Anxiety																
12. Evaluation Anxiety	4.1	1.0	-.07	-.12	-.12	-.12	-.06	-.05	-.16*	-.21**	.51**	-.18**	.54**	(.84\.82)	4.1	1.0

*Notes. Time 1 sub-sample n = 185; Time 2 sub-sample n = 221. "-" means that the corresponding statistic cannot be estimated. * p < .05 (1-tailed), ** p < .01 (1-tailed).*

The pattern of correlations involving the academic performance variables did not markedly differ between the two sub-samples. All measures of academic performance were strongly intercorrelated, and measures of prior semester academic performance correlated fairly with the corresponding measures of end-of-semester academic performance, as expected.

The pattern of correlations involving the self-reported variables varied substantially between the two sub-samples. Concerning approaches to studying, strategic approach to studying correlated with all three measures of academic performance in both sub-samples, but the correlations were slightly stronger in Time 2 sub-sample. Deep approach to studying did not correlate with any of the measures of academic performance in the Time 1 sub-sample, but it did correlate with all of them in the Time 2 sub-sample. Surface approach to studying correlated with coursework grades and GPA but not with examination grades in the Time 1 sub-sample, whereas it correlated with all three measures of academic performance in the Time 2 sub-sample. In all, the pattern of findings is broadly consistent with hypothesis 1.1.

Concerning affect in studying, positive affect correlated with all three measures of academic performance in both sub-samples, but the correlations were slightly stronger in the Time 1 sub-sample. Moreover, positive affect correlated positively with deep and strategic approaches to studying and negatively with surface approach to studying in both sub-

samples. Negative affect did not correlate with any of the academic performance measures in the Time 1 sub-sample, but it correlated negatively with all of them in the Time 2 sub-sample. In all, the pattern of findings is broadly consistent with hypotheses 1.2 through 1.4.

Finally, evaluation anxiety did not correlate with any of the three measures of academic performance in the Time 1 sub-sample, but it correlated negatively with all of them in the Time 2 sub-sample. Moreover, evaluation anxiety correlated with approaches to studying and affect in both sub-samples, and the correlations were strongest with negative affect and surface approach to studying, as expected.

2.3.2   Two-Step Hierarchical Regression Modelling

The two-step hierarchical regression analyses of academic performance are presented in Table 8 for the Time 1 sub-sample and in Table 9 for the Time 2 sub-sample. Concerning the Time 1 sub-sample, Step 1 of the hierarchical regression analyses revealed that prior academic performance and evaluation anxiety conjointly accounted for 33.3% of variance in examination grades, 34.4% in coursework grades and 51.3% in GPA. Moreover, prior academic performance explained each of the three measures of current academic performance, whereas evaluation anxiety did not explain academic performance at all.

Step 2 showed that approaches to studying and affect conjointly accounted for additional and significant 9.1% of variance in examination

grades, 5.8% in coursework grades and 4.1% in GPA. Moreover, positive affect explained all three measures of academic performance, deep approach to studying unexpectedly explained worse coursework grades, whereas negative affect, strategic approach to studying and surface approach to studying did not explain academic performance. In sum, positive affect in the first half of a semester is the strongest psychological correlate of academic performance.

Turning attention to the Time 2 sub-sample, Step 1 of the hierarchical regression analyses revealed that prior academic performance and evaluation anxiety conjointly accounted for 44.2% of variance in examination grades, 36.4% in coursework grades and 44.5% in GPA. Moreover, prior academic performance explained each of the three measures of performance, whereas evaluation anxiety only explained worse examination grades. Step 2 showed that approaches to studying and affect conjointly accounted for additional 7.6% of variance in examination grades, 5.1% in coursework grades and 4.9% in GPA, but these contributions were not significant. Moreover, negative affect explained worse examination performance and worse GPA, but it did not explain coursework performance, whereas positive affect and all three approaches to studying did not explain academic performance at all. In sum, negative affect in the second half of a semester is the strongest correlate of academic performance.

Table 8: *Standardised Regression Coefficients and Coefficients of Determination of the Two-Step Hierarchical Regressions of Academic Performance for the Time 1 sub-sample (Study 1).*

Predictor	Dependent Variable					
	Examination Grades		Coursework Grades		Grade Point Average (GPA)	
	Step 1	*Step 2*	*Step 1*	*Step 2*	*Step 1*	*Step 2*
Past Academic Performance	.557**	.542**	.586**	.541**	.715**	.669**
Evaluation Anxiety	.034	.020	-.006	-.020	-.022	-.034
Deep Approach to Studying	-	-.096	-	-.149*	-	-.083
Strategic Approach to Studying	-	.132	-	.067	-	.003
Surface Approach to Studying	-	.161	-	.002	-	.055
Positive Affect	-	.251**	-	.207*	-	.225**
Negative Affect	-	-.074	-	.054	-	.006
R^2	.330**	-	.344**	-	.513**	-
$R^2 change$	-	.091**	-	.058*	-	.041*

Notes. $n = 185$. "-" means that the corresponding statistic cannot be estimated. * $p < .05$ (1-tailed), ** $p < .01$ (1-tailed).

Table 9: *Standardised Regression Coefficients and Coefficients of Determination of the Two-Step Hierarchical Regressions of Academic Performance for the Time 2 sub-sample (Study 1).*

Predictor	Dependent Variable					
	Examination Grades		Coursework Grades		Grade Point Average (GPA)	
	Step 1	*Step 2*	*Step 1*	*Step 2*	*Step 1*	*Step 2*
Past Academic Performance	.546**	.484**	.578**	.537**	.641**	.583**
Evaluation Anxiety	-.255**	-.050	-.083	.038	-.085	.063
Deep Approach to Studying	-	-.017	-	.082	-	.070
Strategic Approach to Studying	-	.021	-	.091	-	.024
Surface Approach to Studying	-	-.092	-	-.077	-	-.102
Positive Affect	-	.019	-	.062	-	.029
Negative Affect	-	-.294**	-	-.080	-	-.184*
R^2	.442**	-	.364**	-	.445**	-
$R^2 change$	-	.076	-	.051	-	.049

Notes. $n = 221$. "–" means that the corresponding statistic cannot be estimated. * $p < .05$ (1-tailed), ** $p < .01$ (1-tailed).

The analyses conducted on the two sub-samples together provide no support to hypothesis 1.1, in that approaches to studying did not explain academic performance, with the exception of the unexpected, negative effect of the deep approach to studying in the first half of a semester on coursework performance. Yet, the results provide partial support to hypothesis 1.2, in that both positive affect and to a lesser extent negative affect explained some facets of academic performance in the hypothesised directions. Finally, the results provide preliminary support to hypothesis 1.3, in that positive affect explained better academic performance only when measured in the first half of a semester, and to hypothesis 1.4, in that negative affect explained worse academic performance only when measured in the second half of a semester.

2.3.3   Three-Step Hierarchical Regression Modelling

The results of three-step hierarchical regression models are presented in Table 10. Step 1 of the regressions revealed that prior academic performance and evaluation anxiety conjointly accounted for 34.3% of variance in examination grades, 35.1% in coursework grades and 47.5% in GPA. In particular, prior academic performance explained each measure of following academic performance, whereas evaluation anxiety explained only examination grades. Step 2 showed that approaches to studying and affect conjointly accounted for 7.1% of variance in examination performance, 4.1% in coursework performance

and 3.2% in GPA. In particular, positive affect explained all measures of academic performance (applied to all three measures of performance), whereas negative affect and approaches to studying explained none of them. As such, hypothesis 1.1 is not supported, whereas hypothesis 1.2 is supported only for positive affect. Step 3 [6] showed that interactions of affect and semester phase conjointly accounted for additional and significant portions of variance only in examination grades (3.0%) and GPA (1.2%), and additional but not significant 0.5% of variance in coursework grades. Interaction plots in Figure 1 indicate that negative affect is negatively related to examination grades and GPA in the second half of a semester, whereas it is unrelated to both in the first half of a semester. As such, hypothesis 1.3 is not supported, whereas hypothesis 1.4 is supported for two measures of academic performance.

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[6] The three-way interaction (approaches to studying x semester phase x affect) was also tested in Step 3 of hierarchical regression to further explore the relationship between the variables in the model. However, the three-way interaction was not significant, and because there was no specific hypothesis posited regarding this interaction, it was omitted from the final analysis and the report of the results.

Table 10: *Standardised Regression Coefficients and Coefficients of Determination of the Three-Step Hierarchical Regressions of Academic Performance (Study 1).*

Predictor	Dependent Variable								
	Examination Grades			Coursework Grades			Grade Point Average (GPA)		
	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3	Step 1	Step 2	Step 3
Prior Academic Performance	.569**	.520**	.523**	.586**	.544**	.541**	.680**	.642**	.632**
Evaluation Anxiety	-.073**	-.008	-.008	-.037	-.011	-.007	-.054	-.001	.004
Semester Phase (1st = 0, 2nd = 1)	-	-.093	-.098	-	.002	.004	-	-.084	-.081
Deep Approach	-	-.115	-.071	-	-.082	-.072	-	-.043	-.028
Strategic Approach	-	.123	.092	-	.083	.078	-	.017	.011
Surface Approach	-	.067	.065	-	-.021	-.026	-	-.004	-.014
Positive Affect	-	.185*	.140	-	.165**	.160*	-	.154**	.143*
Negative Affect	-	-.134	-.212**	-	.020	-.005	-	-.062	-.100
Positive Affect X Semester Phase	-	-	-.091	-	-	-.014	-	-	-.028
Negative Affect X Semester Phase	-	-	-.187**	-	-	-.075	-	-	-.119*
R^2 (Step 1)	.343**	-	-	.351**	-	-	.475**	-	-
R^2 Change (Step 2)	-	.071**	-	-	.041*	-	-	.032*	-
R^2 Change (Step 3)	-	-	.030**	-	-	.005	-	-	.012*

Notes. $n = 406$. "-" means that the corresponding statistic cannot be estimated. *$p < .05$ (1-tailed), **$p < .01$ (1-tailed).
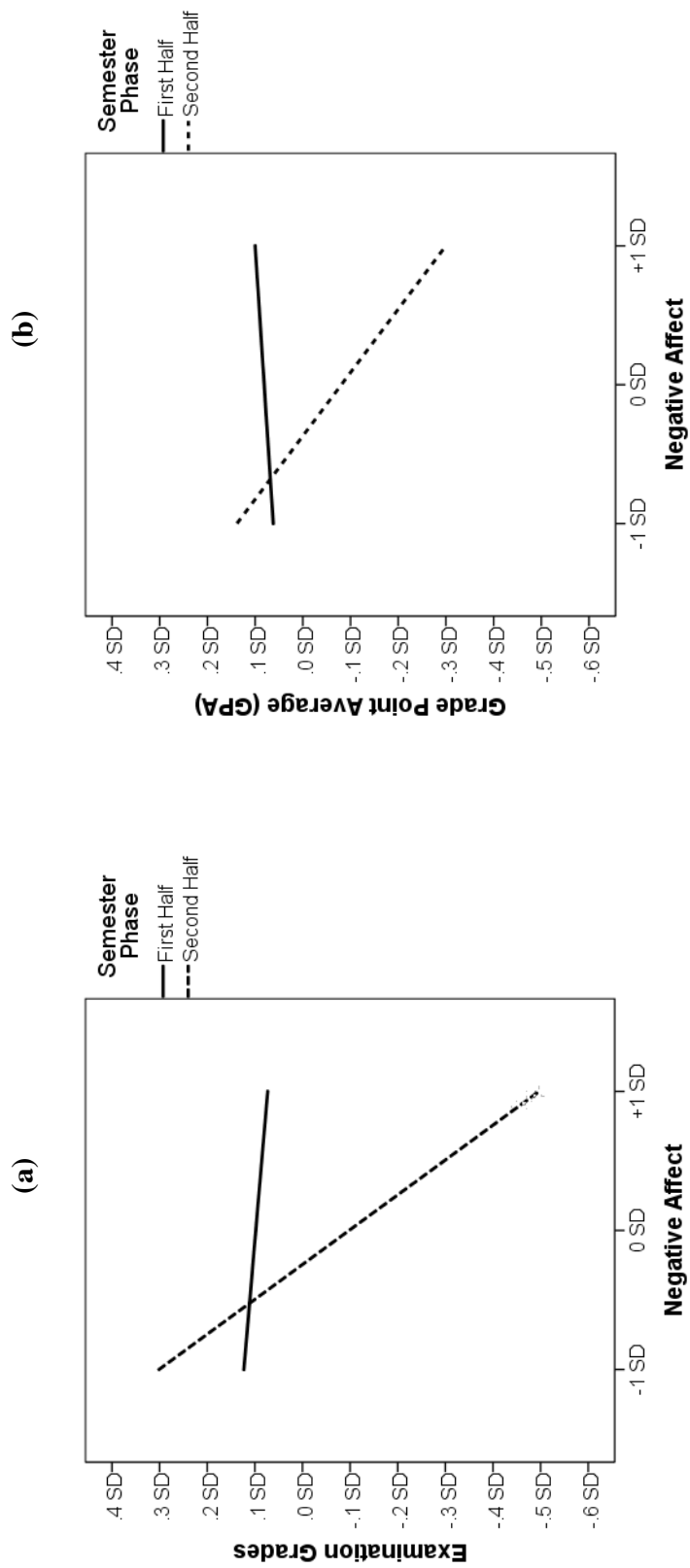
Figure 1: *Interaction graphs of (a) examination grades and (b) Grade Point Average (GPA) as a function of negative affect in studying measured in the first and second half of a semester.*

2.3.4 Mediation analyses

The main finding of this study was that positive affect explained all measures of academic performance. However, positive affect in studying can be a function of students' prior academic performance. Correlation results presented in Table 7 indeed showed positive correlation between the two. As such, it is possible that positive affect mediates the effect of prior semester academic performance on following semester academic performance. A mediation analysis was conducted, in which academic performance was the dependent variable, prior academic performance was the independent variable, positive affect was the mediator, and semester phase, deep, strategic and surface approaches to studying, negative affect and evaluation anxiety, were entered as covariates of the independent variable. The indirect effect of prior academic performance on academic performance through positive affect was positive and significant for GPA (.039; 95% CI: .010 to .088), examination grades (.033; 95% CI: .002 to .111), and coursework grades (.036; 95% CI: .010 to .080). However, these indirect effects accounted only for 5.8%, 5.7%, and 6.2% (in that order) of the total effects of prior academic performance on academic performance. As such, these findings suggest that the reinforcement process (i.e., good prior academic performance fosters positive affect, which in turn fosters good academic performance) is weak.

2.3.5 Sensitivity analyses on background variables

In order to assess how sensitive the main findings of this study were in respect to background variables that were not controlled for in the regression models, the six key bivariate correlations (i.e., those between positive and negative affect, on the one hand, and the three measures of academic performance, on the other hand) were estimated separately on sub-samples of participants and compared between sub-samples. In order to have an acceptable statistical power, only sub-samples with more than 100 participants were compared. There was no significant difference in any of the six key correlations between Life Sciences students, Business School students, and students in a mixed group (Social Sciences, and Humanities and Law). Moreover, there was no difference in the six key correlations between British and non-British participants, as well as between White and non-White participants. Finally, for all sub-samples, positive affect correlated positively with all three measures of academic performance, whereas negative affect correlated negatively. Noticeably, although non-British and non-White students reported on average more negative affect than British and White students did, there was no national or ethnic difference in the direction and strength of the relationships between negative affect and academic performance. In all, the sensitivity analyses indicated substantial consistency of the findings across student background variables, and suggested that the considered background

variables do not moderate the relationships between affect in studying and academic performance or that, if present, the moderation is weak.

2.4   Discussion

Results of hierarchical regression modelling indicate that (a) affect in studying is a stronger correlate of academic performance than are approaches to studying, (b) positive affect explains better overall academic performance, and (c) negative affect measured in the second half of a semester explains worse examination performance. These findings highlight the importance of student's emotions on learning progress.

Among all the competing correlates, the strategic approach to studying correlated most strongly with positive affect in studying, whereas the surface approach to studying correlated most strongly with negative affect in studying. As such, an explanation for the failure of the strategic approach to studying to explain academic performance is that positive affect in studying is a partially overlapping and a better correlate. By the same token, an explanation for the failure of the surface approach to studying to explain academic performance is that negative affect in studying is a partially overlapping and a better correlate. In all, the findings of the bivariate correlation analysis are in line with those of previous studies, whereas the findings of the regression analysis contradict previous studies i.e., the relationships between strategic and

surface approaches, on the one hand, and academic performance, on the other hand, vanished when controlling for affect.

Among all self-reported variables used as correlates of academic performance, positive affect turned out to be the best correlate of overall academic performance, and negative affect measured in the second half of a semester turned out to be the best correlate of examination performance. Because hierarchical regression models controlled for prior academic performance, these findings rule out the alternative hypothesis that high-performing students enjoy studying and low-performing students do not. Moreover, mediation analyses found that the indirect effect of prior academic performance on academic performance through the mediation of positive affect is significant but small. This implies that the reinforcement process is present but weak. As such, positive and negative affect explains academic performance independently of prior academic performance.

The findings that positive affect in studying is a stronger correlate of performance than the strategic approach to studying and that negative affect in studying is a stronger correlate of performance than the surface approach to studying conjointly suggest that affect is a better indicator of learning progress than are approaches to studying. To put it simply, asking students "how do you feel when you are studying?" seems to provide more insight into learning progress, or lack thereof, than asking students "how do you study?". These findings are consistent with the

control-process model of self-regulation of intentional behaviour (Carver & Scheier, 1990, 2000), which views positive affect and negative affect in an endeavour as guides for one's intentional behaviour.

However, the predictions drawn from the control-process model concerning the time dynamic of the effects of affect on academic performance were only partially supported. On the one hand, semester phase moderated the relationship between negative affect and examination performance. Thus, negative affect in the first phase did not explain performance, whereas negative affect in the second phase explained worse performance. On the other hand, semester phase did not moderate the relationships between positive affect and the three measures of academic performance. Therefore, the final inference is that positive affect better explains overall academic performance no matter in which semester phase it is measured.

The failure to detect a coasting effect for positive affect can only be explained within the control-process model by assuming that some students recalibrated their achievement goals (making them more ambitious) all along the semester. Therefore, positive affect for those students was a valid indicator of learning progress both in the first and in the second phases of a semester. The failure to detect a coasting effect can also be explained by competing theories of emotions. The broaden-and-build model of positive emotions (Fredrickson, 2001) posits that positive emotions expand one's attention, cognitive efficiency and behavioural

repertoires (broaden hypothesis). Based on the broaden hypothesis (Fredrickson, 2001) one would expect positive affect in studying to foster learning progress and performance, and in doing so to offset the negative effect of coasting.

The findings of this study should be evaluated in the light of three key methodological limitations. First, a stronger test of semester phase as a moderator would require measuring affect longitudinally from the start to the end of a semester. Second, as for any longitudinal study with a limited number of points in time, these findings do not imply causality. Finally, this study gathered data from a heterogeneous students sample from various faculties, ethnic backgrounds, and nationalities. Such a sample is an appropriate choice for an initial testing of the research hypotheses, but does not allow for testing proposed regression models on sub-samples of students with different backgrounds.

Despite its limitations, the present study indicates for the first time that students' experience of positive and negative emotions in studying are linked prospectively to all facets of academic performance, and that the links stand after controlling for approaches to studying, evaluation anxiety, and prior compatible academic performance. As such, this study provides further support for the importance of emotions in learning and academic performance and overall supports the previous findings that positive affect in studying is a strong correlate of better academic performance.

Importantly, experimentally induced positive mood has been found to facilitate more flexible (Hirt, 1999; Hirt et al., 1997) and inclusive (Isen & Daubman, 1984) categorisation of information, more unusual word associations (Isen et al., 1985), better problem solving (Isen et al., 1987), more cognitive flexibility (Hirt et al., 2008) and more divergent thinking (Vosburg, 1998). These are characteristics of creative thinking and as such, positive affect appears to facilitate various processes important for creativity. Therefore, further research should examine the relationship between positive affect in studying and the use of creative thinking strategies in studying.

CHAPTER 3 – STUDY 2 AND STUDY 3

Development and Validation of the Short Use of Creative Cognition

Scale in Studying

Abstract

The two studies presented in this chapter report development and validation of a short Use of Creative Cognition Scale in studying (UCCS). The UCCS was inspired by the Cognitive Processes Associated with Creativity (CPAC) scale. In Study 2, items from two of the six subscales of the CPAC were excluded due to conceptual and psychometric issues to create a 21-item CPAC scale, which was administered to 517 university students. Exploratory factor analysis revealed that the 21-item CPAC scale is unidimensional. Five items were selected to create the new unidimensional UCCS. In Study 3, 696 students completed the UCCS and a set of scales measuring related constructs. Confirmatory factor analysis corroborated the unidimensional structure of the scale. The scale correlated positively with measures of flow, trait intrinsic motivation, adaptive metacognitive traits and positive affect, it correlated negatively with negative affect, and it did not correlate with core maladaptive metacognitive traits. The findings indicate that the scale is a valid and reliable tool for research and monitoring.

3.1   Introduction

Multiple measures of creativity were developed and validated throughout the history of research on creativity. These include self-reported questionnaires, tests and third party ratings, which have in common issues with validity, reliability and practicality (Feldhusen & Ban Eng Goh, 1995; Miller, 2009). The existence of valid and reliable tools for measuring creativity is paramount for advancing the understanding of creativity phenomenon and ways of studying it. The review of the research examining the relationship between creativity and academic performance led to a new way of looking at creative thinking in relation to studying. According to the creative cognition approach, creative thinking is a characteristic of everyone who thinks. Therefore, the actual deployment of creative thinking to an endeavour is more important in studying and should relate to better learning and academic performance rather than creative ability per se.

The Cognitive Processes Associated with Creativity scale (CPAC; Miller, 2009) was recently developed that taps more specifically into the beliefs about and the use of cognitive processes associated with creativity. However, the review of the scale's psychometric properties suggested that it has problems with construct validity and reliability of its subscales. Hence CPAC can be regarded as work in progress. Nevertheless, the CPAC scale has inspired the present study's attempt to develop a short

and direct measure, which would assess specifically the use of cognitive processes associated with creativity, or simply creative cognition.

3.1.1 The CPAC scale

Miller's (2009) CPAC scale provides an adequate item selection pool to constitute a handy self-reported scale measuring the use of and beliefs about the usefulness of cognitive processes associated with creativity in problem solving. The CPAC scale consists of six subscales: Idea Manipulation, Idea Generation, Imagery/Sensory Cognitive Strategy, Flow, Metaphorical/Analogical Thinking and Incubation. The dimensionality of the item scores was identified using principal axis factoring, the minimum average partial (MAP) method and parallel analysis, resulting in six correlated factors that were both statistically and conceptually acceptable. The original scale had 45 items, of which 17 were reversed questions. Subsequently, all reversed items and all items that had double factor loadings were removed, leaving 28 items in the final scale.

The Idea Manipulation subscale measures beliefs about usefulness of joining different ideas together to come up with new and adaptive solutions rather than the frequency of using idea manipulation techniques (e.g., "Joining together different elements can lead to new ideas"). The Idea Generation subscale measures the frequency of engaging in initial brainstorming (e.g., "While working on a problem, I try to generate as

many ideas as possible"), namely, generating as many relevant ideas as possible without evaluating their effectiveness or usefulness for any particular situation (Davis, 2004). These subscales had initially been named Perspective Taking and Brainstorming, respectively. The renaming of the subscales was necessary to accommodate items that in the validation study showed different factor loadings from those of the scale development study. Thus, some items switched their loadings between the two subscales – from the scale development study to the scale validation study – suggesting that they are measuring the same construct through belief about usefulness and the actual frequency of use of this particular cognitive strategy associated with creativity.

The remaining subscales were more stable in their factor loadings across the scale development and scale validation studies. The Imagery/Sensory Cognitive Strategy subscale measures the frequency of using techniques like visualisation of potential new solutions to the problem or imagining how a particular solution may work (e.g., "If I get stuck on a problem, I visualize what the solution might look like"). The Metaphorical/Analogical Thinking subscale measures both the beliefs about usefulness and the frequency of taking a previous solution and adapting it to a new situation (e.g., "Incorporating previous solutions in new ways leads to good ideas") or of looking at the situation from a new perspective, which may lead to the emergence of a distinctively new idea (Davis, 2004). The Incubation subscale measures the frequency of

engagement in subconscious mental activity that an individual is unaware of while engaged in other, usually routine tasks (Davis, 2004) (e.g., "When I get stuck on a problem, a solution just comes to me when I set it aside"). Finally, the Flow subscale measures the frequency of experiencing a highly automatic, effortless state of complete absorption in the activity that is also characterised by loss of self-consciousness and heightened focus of attention (Csikszentmihalyi, 1997) (e.g., "I can completely loose track of time if I am intensely working").

The internal consistency of the aggregate CPAC scale score was .855. The internal consistency of the subscales was less satisfactory ranging from .378 to .738. In particular, the Incubation subscale failed by a large margin to reach acceptable reliability (alpha = .378), and the Metaphorical/Analogical Thinking and Idea Generation subscales just failed to reach acceptable reliability (alpha = .684 and .602, respectively). The remaining three subscales of Idea Manipulation, Imagery/Sensory Cognitive Strategy and Flow showed good internal consistency (alpha = .736, .738, and .729, in that order). The subscales positively correlated with one another with the exception of the Incubation subscale, which showed no relationship with the Idea Generation and Metaphorical/Analogical Thinking subscales; and with the exception of the Flow subscale, which showed no relationship with the Metaphorical/Analogical Thinking subscale (Miller, 2009). In sum, the CPAC scale has important limitations, but it is a valuable source of items

for developing a short self-reported scale that measures the use of creative cognition in studying as a habit.

3.2   Study 2: Scale Development and Exploration of its Factor Structure

Study 2 examined the psychometric properties of the CPAC scale and selected a subset of its items to develop the new UCCS. Though the items of the UCCS are derived from the CPAC scale, the two scales can be conceptualised as measuring two somewhat distinct constructs. The items of the original CPAC scale measure a mixture of beliefs and behaviours, whereas the items of the UCCS measure behavioural habits in the domain of studying, that is, students' tendency to deploy creative thinking to studying. Therefore, the new scale was given a new name to reflect its distinctive focus.

The review of the psychometric properties of the CPAC scale showed that the Incubation subscale was not measuring the intended cognitive process adequately. The reason for that could be that incubation is an unconscious or in case of cognitive psychologists referred to as having a lower level of consciousness thinking. As such, it is impossible for an individual to voluntarily engage in incubation process the same way as s/he can engage in other creative thinking strategies. Therefore, the Incubation subscale was removed from the CPAC scale for the purpose of this study.

Flow is considered to be a state of complete absorption in any particular activity (Csikszentmihalyi, 1991) rather than a cognitive strategy, and there is also no evidence that people can deliberately enter flow as much as they can, for example, deliberately engage in brainstorming. Even though flow is a state that may lead to creativity (Csikszentmihalyi, 1997), it would be appropriate to keep them separate and study them as related but independent constructs. Therefore, the Flow subscale was also removed from the CPAC scale for the purpose of this study.

The first aim of the present study is to explore the factor structure of the CPAC scale in the specific domain of studying. Having removed the items of two of the original subscales, the factor structure of the scale will be examined on the items of the remaining four subscales. It was hypothesised that:

H 2.1   The 21-item CPAC scale will have a four-factor structure

The second aim of the study is to develop a short measure assessing the frequency of use of creative cognition in studying using items taken from the CPAC scale. Miller (2009) proposed that an overall CPAC scale score could be calculated as the average of all items in the scale, which would give a single measure of cognitive processes associated with creativity. Thus, the development of a short and

unidimensional scale measuring the overall tendency to use creative cognition when engaged in problem solving is the logical next step. The strategy for that involves identifying one or two representative items from each subscale of the CPAC. It was hypothesised that:

H 2.2   The short UCCS will have a unidimentional structure.

3.3   Method

3.3.1   Participants

An opportunity sample of 825 students from a London university was invited to take part in this study. The response rate was 62.7%, resulting in a final sample of 517 students. The sample comprised 120 (23.2%) males with age range 18 to 54 ($M = 29$; $SD = 9.4$) and 395 (76.4%) females with age range 18 to 62 ($M = 25$; $SD = 7.2$). Two participants (0.4%) withheld information about their gender. The age and gender composition of the sample is similar to that of the first study (Chapter 2), suggesting that the study sample is representative of the university's population. Participants' demographic characteristics are summarised in Table 11.

The sample consisted of 252 (48.7%) UK nationals, 257 (49.8%) citizens of other countries, and 8 (1.5%) withheld information about their nationality. Ethnically participants were: 274 (53%) White, 78 (15.1%) Black, 35 (6.8%) Asian, 40 (7.7%) of mixed ethnicity, 70 (13.5%) from

other ethnic backgrounds, and 20 (3.9%) withheld information about their ethnic origin.

Table 11: *Summary of Participants' Demographic Characteristics (Study 2).*

Variable	N	%
Gender		
Male	120	23.2
Female	395	76.4
Unknown	2	0.4
Faculty		
Life Science	195	37.7
Business School	116	22.4
Social Science and Humanities	107	20.7
Law and International Relations	67	13
Other	11	2.1
Unknown	21	4.1
Degree level		
Foundation	18	3.5
1st year	211	40.7
2nd year	114	22.1
3rd year	82	15.9
Postgraduate	89	17.2
Unknown	3	0.6
Ethnicity		
White	274	53
Black	78	15.1
Asian	35	6.8
Mixed	40	7.7
Other	70	13.5
Unknown	20	3.9
Nationality		
British	252	48.7
Non-British	257	49.8
Unknown	8	1.5

Participants were from various faculties within the university: 195 (37.7%) from the Faculty of Life Science, 116 (22.4%) from the Business School, 67 (13%) from the Faculty of Law and International Relations,

107 (20.7%) from the Faculty of Social Science and Humanities, 11 (2.1%) from other faculties within the university, and 21 (4.1%) withheld the information about their subject area. Students were also from different years of their degree programme: 18 (3.5%) were foundation degree students, 211 (40.7%) were first year undergraduate students, 114 (22.1%) were second year undergraduate students, 82 (15.9%) were third year undergraduate students, 89 (17.2%) were postgraduate students, and 3 (0.6%) withheld that information. The data for undergraduate and postgraduate students was analysed together as there was neither theoretical reason nor research evidence suggesting that students at different levels of their degree would differ in cognitive processes associated with creativity. As expected, the t-test of mean differences in use of creative cognition between undergraduate and postgraduate students was non-significant.

3.3.2   Measures

Cognitive Processes Associated with Creativity Scale (CPAC; Miller, 2009) is a 28-item self-reported questionnaire measuring cognitive processes associated with creativity on six subscales. This study used an adapted version of the questionnaire consisting of 21 self-reported items measuring creative cognition spanning on four subscales: Idea Manipulation (e.g., "Joining together different elements can lead to new ideas"), Imagery/Sensory Cognitive Strategy (e.g., "If I get stuck on a

problem, I visualize what the solution might look like"), Metaphorical/Analogical Thinking (e.g., "Incorporating previous solutions in new ways leads to good ideas"), and Idea Generation Cognitive Strategy (e.g., "While working on a problem, I try to generate as many ideas as possible"). Miller's original instructions for filling in the CPAC questionnaire were: "Following is a series of statements about personal preferences in behaviour. Please indicate how frequently you engage in each behaviour". In the present study the instructions were contextualised to studying as follows: "Following is a series of statements about personal preferences and behaviours. Please indicate how frequently you engage in each behaviour during your study. Please respond thinking of your general studying experience and behaviour across situations and times". Thus, participants were asked to respond thinking about their study at the university in general rather than about their study on any particular module or class. Thus, the scale measures creative cognition as a domain-specific disposition. Responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The scores for each subscale were calculated averaging the items from that particular subscale, resulting in a minimum possible score of 1 and maximum possible score of 5. Additionally, the scores could be calculated for the whole scale by averaging all items in the scale. The internal consistency of the original 28-item CPAC scale was .855, and the

reliability of the four selected subscales ranged from .602 to .738 (Miller, 2009).

3.3.3 Procedure

Ethics approval for the study was obtained from a university ethics board. The data collection took place throughout the two semesters of the academic year. The data were collected electronically using SurveyMonkey. The invitation letter, information sheet with explanations of the purpose and procedure for the study and the hyperlink to the electronic copy of the questionnaire were sent to students' university e-mail addresses. Access to the survey was conditional to providing informed consent. The data for each participant was anonymised (i.e., link between e-mails and responses was removed) and pulled together with the data from other participants prior to data analysis.

3.3.4 Data analysis

The factor structure of the 21 CPAC items was analysed using principal axis factor analysis in SPSS. The number of factors to be extracted was assessed by (a) inspecting the scree plot of eigenvalues in SPSS, (b) using parallel analysis (Henson, & Roberts, 2006), based on simulations of 10,000 samples and using the method of data matrix permutation, as implemented in ViSta-PARAN (Young, 2003), and (c) by inspecting, interpreting and comparing the patterns of factor loadings

obtained by extracting one or more factors in SPSS. Whenever more than one factor was extracted, the pattern of factor loadings was assessed based on oblique Promax factor rotation (adopting kappa = 4).

3.4 Results

3.4.1 Exploration of the factor structure of the CPAC scale

The results of the principal axis factor analysis yielded a Kaiser-Meyer-Olkin (KMO) statistic of .937, which exceeds the satisfactory standard for sampling adequacy of .7, and three eigenvalues greater than 1: 8.111, 1.473, and 1.147. The scree plot shown in Figure 2 suggested that only one factor should be extracted.
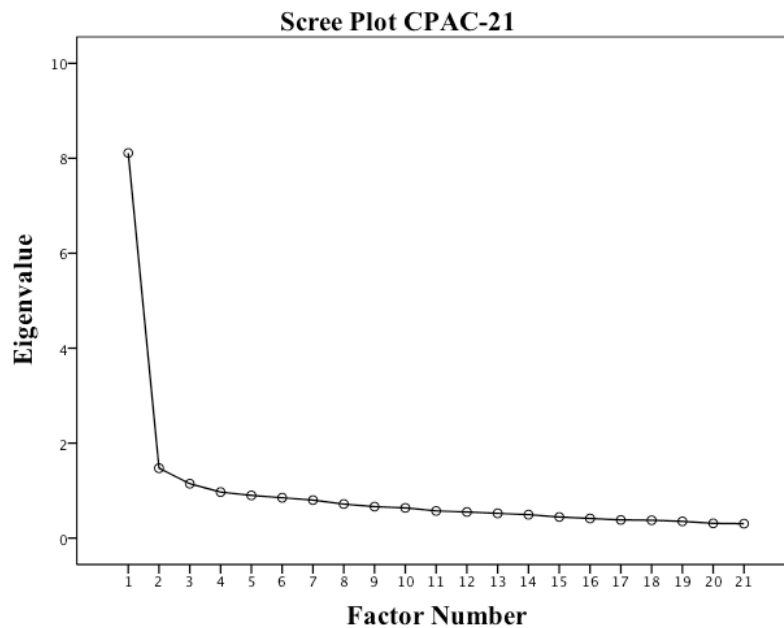
Figure 2: *Scree plot of the 21-item CPAC scale*.

Parallel analysis estimates of the upper 95th percentile for the first three eigenvalues were 1.439, 1.357, and 1.298. Because only the first two observed eigenvalues exceeded their respective upper 95th percentile, parallel analysis indicated that two factors should be extracted. The first factor accounted for 38.62% of the variance, and the second factor accounted for additional 7.02% of the variance. The pattern of factor loadings was assessed based on an oblique Promax factor rotation (kappa = 4). The estimated correlation between the two factors was .703, suggesting poor discriminant validity. Fifteen items loaded primarily on the first factor, whereas the remaining six items loaded primarily on the second factor. The descriptive statistics, the factor loading for two-factor solution and for a single factor solution are presented in Table 12.

The items loading primarily on the second factor were a mixture of items coming from the four subscales of the CPAC, and hence were hardly interpretable as a single construct. In consideration of the small portion of variance accounted for by the second eigenvalue, the strong correlation between factors, and the mixed item content of the second factor, the 21-item CPAC scale appears to be a unidimensional instrument. Moreover, the relatively small portion of variance accounted for by a single factor indicates that item reduction is in order.

Table 12: *Means, Standard Deviations and Factor Loadings of the CPAC*

21 Items for Two-factor and One-factor solutions (Study2).

Item	X	SD	F1	F2	Single factor
I find effective solutions by combining multiple ideas	3.6	.9	.866	-.127	.743
While working on a problem, I try to imagine all aspects of the solution	3.4	.9	.752	-.049	.699
While working on something, I try to generate as many ideas as possible	3.6	.9	.75	-.085	.666
I try to act out potential solutions to explore their effectiveness	3.7	.9	.746	-.077	.669
I get good ideas by joining together different elements	3.6	.9	.72	-.086	.636
Incorporating previous solutions in new ways leads to good ideas	3.6	.9	.669	-.045	.621
Looking at a problem from a different angle leads me to a solution	3.7	.8	.639	.079	.694
If I get stuck on a problem, I try to take a different perspective of the situation	3.8	1.0	.596	.161	.72
If I get stuck on a problem, I try to apply previous solutions to the new situation	3.8	.9	.576	.006	.571
If I get stuck on a problem, I make connections between my current problem and a related situation	3.5	1.0	.564	.156	.684
Thinking about more than one idea at the same time leads me to a new understanding	3.7	.9	.558	.113	.643
If I get stuck on a problem, I visualize what the solution might look like	3.7	.9	.547	.074	.6
Becoming physically involved in my work leads me to good solutions	3.5	1.0	.494	.125	.59
Imagining potential solutions to a problem leads me to new insights	3.1	1.1	.419	.34	.69
While working on something, I try to fully immerse myself in the experience	3.2	1.1	.348	.335	.617
If I get stuck on a problem, I look for clues in my surroundings	3.5	1.1	-.023	.679	.524
If I get stuck on a problem, I look for details that I normally would not notice	3.3	1.0	.012	.613	.506
While working on something, I often pay attention to my senses	3.5	1.0	.007	.530	.436
I get good ideas while doing something routine, like driving or taking a shower	3.5	1.0	-.007	.460	.367
In the initial stages of solving a problem, I try to hold off on evaluating my ideas	3.5	1.0	-.058	.447	.307
If I get stuck on a problem, I ask others to help generate potential solutions	3.1	1.0	-.057	.407	.275

Notes. n = 517. Range of the response scale: 1-5.

3.4.2   Development of the UCCS

Five items in total were selected for inclusion in the UCCS. In Miller's (2009) original research the CPAC scale was developed and validated through two separate studies. In the present study, the items from each of the four subscales of the CPAC were selected considering both the factor loadings that Miller (2009) estimated in her scale development and scale validation studies and the factor loadings estimated in the present study for a single factor scale, as follows.

The first selected item was "Incorporating previous solutions in new ways leads to good ideas". Although this item would seem to measure a belief rather than behaviour, the instructions for answering the questionnaire as a whole explicitly asked participants to focus on their studying experience and behaviour. Moreover, the strong factor loading of this item indicates that respondents generally interpreted it as their own behaviour and the experience of its consequences. In particular, this item had a strong factor loading in the present study (.621) and in Miller's (2009) scale development (.598) and scale validation (.588) studies. The second item was "I try to act out potential solutions to explore their effectiveness". This item had a strong factor loading in the present study (.669) and in Miller's scale development (.626) and scale validation (.710) studies. The third item was "While working on something, I try to generate as many ideas as possible". This item had a strong factor loading

in the present study (.666) and acceptable factor loadings in Miller's scale development (.389) and scale validation (.536) studies. The fourth item was "If I get stuck on a problem, I try to take a different perspective of the situation". This item had a strong factor loading (.720) in the present study and acceptable factor loadings in Miller's scale development (.549) and scale validation (.392) studies. The fifth and final item was "I find effective solutions by combining multiple ideas". This item had a strong factor loading (.743) in the present study. It is important to note that this last item had been modified from the original ("Combining multiple ideas can lead to effective solution") to emphasise actual behaviour over belief in line with the style of the other selected items. The original item showed only medium-strength factor loadings in Miller's (2009) scale development (.482) and scale validation (.588) studies. The stronger factor loading estimated in the present study indicates that the modification of this item was successful.

The scores of the five selected items, which form the new possibly unidimensional UCCS, were analysed using principal axis factor analysis. One factor accounted for 48.05% of the variance. Table 13 shows the descriptive statistics and the factor loadings of each item, which were all strong. The Cronbach's alpha coefficient was .82, which is good for a short scale. In all, the UCCS appears to have good construct validity and internal consistency.

Finally, it is important to acknowledge that even though the five items of the UCCS were selected from four subscales of the CPAC, each item individually cannot be used to measure and adequately represent any particular cognitive process associated with creativity. Thus, the UCCS is unidimentional and should be used just as a general measure of the frequency of use of creative cognition in studying.

Table 13: *Means, Standard Deviations, and Factor Loadings of the UCCS Items (Study 2).*

Item	X	SD	Loading
I find effective solutions by combining multiple ideas	3.6	.9	.763
While working on something, I try to generate as many ideas as possible	3.8	1.0	.725
I try to act out potential solutions to explore their effectiveness	3.4	.9	.665
If I get stuck on a problem, I try to take a different perspective of the situation	3.7	.9	.664
Incorporating previous solutions in new ways leads to good ideas	3.7	.8	.639

Notes. $n = 517$. Range of the response scale: 1-5.

3.5   Study 3: Corroboration of Factor Structure and Assessment of Concurrent and Discriminant Validity

The third study had two goals. The first goal was to further evaluate the construct validity and internal consistency of the UCCS, which was developed in Study 2, on a new student sample. The second

goal was to evaluate the concurrent validity of the UCCS in relation with conceptually related constructs and scales and its discriminant validity.

3.5.1   Use of creative cognition and dispositional flow

Flow was originally defined as a state (Csikszentmihalyi, 1991), and it was later defined and measured as a state and a domain-specific trait (Jackson & Eklund, 2002). The present study investigates study-related dispositional flow meant as a trait specific to the domain of study activities. The construct of flow has been defined in somewhat different ways since its inception. Each definition led to the development of a specific scale of measurement (Moneta, 2012a). Two such conceptualisations will be considered in this study.

In the original definition (Csikszentmihalyi, 1975) flow was characterised by three components that have to occur simultaneously in order for an individual to experience flow: loss of self-consciousness, focus of attention, and merging of action and awareness. In the most recent definition (Csikszentmihalyi, 1991; Jackson & Eklund, 2002) flow was characterised by nine components that can trade-off in influencing the experience of flow: dynamic balance between challenge and skill, focused concentration on the present activity, sense of control over one's actions, merging of action and awareness, clear proximal goals, unambiguous feedback, loss of self-consciousness, loss of time-awareness or time acceleration, and autotelic experience (i.e., intrinsically motivated

and rewarding in itself). The measures of flow associated with each of these two definitions converge empirically, but the strength of their correlation is only fair, indicating that they measure related but somewhat distinct constructs (Moneta, 2012b).

Flow is universally considered to be an important facilitator of creativity (for a review see Csikszentmihalyi, 1997). Furthermore, flow was integrated in the original CPAC scale and the Flow subscale positively correlated with all other subscales of the CPAC apart from Analogical/Metaphorical Thinking (Miller, 2009). Although it is not clear if flow is an antecedent or a consequence of engaging in creative thinking, measures of the two constructs should converge. Therefore, it was hypothesised that:

H 3.1   Both measures of flow will positively correlate with the UCCS.

3.5.2   *Use of creative cognition and trait motivation*

Intrinsic motivation is the tendency to get involved with the task because it is perceived to be interesting and enjoyable. As such, the person identifies him/herself with the task's values and integrates them into the sense of self. On the other hand, extrinsic motivation is the tendency to get involved with the task in order to gain a reward or avoid a punishment; so that, it is hinging on one's desire for approval, avoidance of shame, and contingent self-esteem (Deci & Ryan, 2008).

Originally, motivation was studied as a state variable that changes across situations and times. Later, it was also defined as a trait variable. Trait motivation represents individual differences in the tendency to be more or less intrinsically or extrinsically motivated in the domains of study and work (Amabile, Hill, Hennessey, & Tighe, 1994).

It has been consistently found that trait intrinsic motivation positively relates to "product" creativity measured using the consensual assessment technique (Amabile, 1996). On the other hand, in different samples trait extrinsic motivation was sometimes negatively correlated with "product" creativity, other times uncorrelated, and occasionally even positively correlated (Amabile, 1996). Conceptually, trait intrinsic motivation should foster engagement in creative cognition, whereas trait extrinsic motivation may do so only if a person anticipates that engaging in those processes will lead to rewards. Therefore, no hypothesis was posited for trait extrinsic motivation, whereas for trait intrinsic motivation it was hypothesised that:

H 3.2   Intrinsic motivation will positively correlate with the UCCS.

3.5.3   Use of creative cognition and affect

Emotions and creativity have a long lasting relationship. Numerous studies examined the effect of both positive and negative emotions on creativity (eminent and everyday). At the end of the Chapter

2 several studies examining the relationship between creativity and positive affect were presented. Overall positive affect has been consistently found to have a positive relationship with creativity, especially when measuring creativity in problem solving and everyday life (e.g., Baas, De Dreu, & Nijstad, 2008; Isen et al., 1987; Vosburg, 1998). Moreover, evidence from longitudinal studies on workers suggests that positive affect explains a subsequent increase in creativity (Amabile, Barsade, Mueller, & Staw, 2005). Nevertheless, there is an argument in creativity research suggesting that different emotions can differently relate to different facets of creativity (Kaufmann, 2003; Vosburg & Kaufmann, 1997).

Negative affect was also found to have a positive relationship with creativity, but mainly with artistic creativity (for a review see Russ, 1998). However, the findings from studies of negative affect are equivocal, with some reporting negative affect to have no relationship with creativity (Isen et al., 1987) or even a negative relationship (Vosburg, 1998). As such, it is possible that negative affect facilitates particular types of creativity like "product" and "person" creativity, whereas it should hinder creative thinking by virtue of narrowing the scope of attention. Therefore, it was hypothesised that:

H 3.3   *Positive affect will positively correlate, whereas negative affect will negatively correlate with the UCCS.*

3.5.4 Use of creative cognition and adaptive and maladaptive metacognitive traits

Metacognition comprises psychological structures, beliefs and control functions that support the interpretation and modification of thinking itself (Flavell, 1979). Metacognition includes clear ideas about strategies that one can use to perform a particular task, such as when any particular strategy can be useful, what skills are required, what are the potential obstacles, how much time will it take to complete the task and what the benefits will be, and the self evaluation of one's own preferences and habits (Antonietti, Ignazi, & Perego, 2000). In educational research, metacognition typically refers to a higher order thinking, which entails active regulation of the cognitive processes involved in learning, such as planning how to do a task, monitoring comprehension, and evaluating the progress made when the task is accomplished (Schraw, 1998).

A number of metacognitive strategies were specifically identified in the context of problem solving: identifying the nature of a problem, identifying actions that can be taken, making an action plan, allocating required resources and monitoring the progress (Allen & Armour-Thomas, 1993; Sternberg, 1986). Metacognition also showed to play an important role in effective and creative problem solving (Antonietti et al., 2000). Problem solving can occur in virtually any task at hand and is one of the main areas of application for creativity.

From a personality psychology perspective, metacognitive processes are relatively stable beliefs that can be broadly separated into adaptive and maladaptive, in that they either facilitate or hinder problem solving in challenging situations (Beer & Moneta, 2010). Three broad adaptive metacognitive traits have been identified to date. The first one is Confidence in Extinguishing Perseverative Thoughts and Emotions, which frees up cognitive resources for more effective functioning. The second one is Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving, which allows for evaluation of a situation and helps to set up the mind for problem solving. The third one is Confidence in Setting Flexible and Feasible Hierarchies of Goals, which supports the adaptability to a problematic situation that is essential for succeeding in long-term endeavours (Beer & Moneta, 2010). Each of these traits is likely to provide some support to the individual who is willing to engage in the cognitive processes potentially leading to creativity. Therefore, it was hypothesised that:

H 3.4   All three adaptive metacognitive traits will positively correlate with the UCCS.

From a clinical psychology perspective, maladaptive metacognitions are theorised to foster excessive threat monitoring,

perseverative thinking, and maladaptive coping (i.e., disengagement and avoidance coping) in response to external stimuli as well as to one's own internal states. Three types of metacognition have been identified to be central to the development and maintenance of psychological dysfunction. These are 1) metacognitive beliefs (beliefs individual has about own cognition and internal states), 2) thoughts (conscious interpretation of cognitive experience) and 3) metacognitive control and regulation (selective allocation of attention for monitoring, checking and planning) (Wells, 2000). Importantly, the maladaptive underlying metacognitive mechanisms are characterised by negative, cyclical and rigid thinking. It is these mechanisms rather that the content of the thought itself that contribute to and maintain psychological dysfunction (Wells, 2000; Wells & Matthews, 1994). As such, maladaptive metacognition can be seen as a vulnerability factor in predisposing individuals to maladaptive behaviour. Thus, individuals who hold maladaptive metacognitive beliefs are more likely to get locked in perseverative thinking and maladaptive coping, and hence are unlikely to adopt effective ways of thinking and acting.

Five broad maladaptive metacognitive traits have been identified to date: Positive Beliefs about Worry (worry is believed to help cope with demands), Negative Beliefs about Thoughts Concerning Uncontrollability and Danger (worry is believed to be harmful and unstoppable), Cognitive Confidence (lack of), Beliefs about the Need to Control Thoughts (bad

thoughts are believed to be dangerous, and they hence must be stopped and prevented), and Cognitive Self-Consciousness (the tendency to monitor one's own thoughts and emotions).

These traits were found to explain maladaptive learning processes such as the surface approach to studying and avoidance coping in studying. Importantly, maladaptive metacognitive traits were found to be uncorrelated with adaptive learning processes such as deep and strategic approaches to studying and approach coping in studying (Spada & Moneta, 2012; Spada, Nikcevic, Moneta, & Ireson, 2006). Moreover, while being strongly and inversely correlated with the adaptive metacognitive trait of Confidence in Extinguishing Perseverative Thoughts and Emotions (i.e., Factor-1 of Positive Metacognitions and Meta-Emotions Questionnaire), maladaptive metacognitive traits are from uncorrelated to weakly and negatively correlated with the other two adaptive metacognitive traits (i.e., Factor-2 and Factor-3 of Positive Metacognitions and Meta-Emotions Questionnaire) (Beer & Moneta, 2010). In all, these findings indicate that maladaptive metacognitive traits are not inverse of adaptive metacognitive traits and they do not undermine adaptive behaviour as such. Therefore, maladaptive metacognition should be relatively independent of the use of creative cognition in studying, which can be seen as an advanced form of adaptive coping in problem solving. The analysis of the correlations between the

UCCS and maladaptive metacognitive traits will provide a means to assess the discriminant validity of the scale. It was hypothesised that:

H 3.5   Maladaptive metacognition will be uncorrelated with the UCCS.

3.6   Method

3.6.1   Participants

An opportunity sample of 1,000 students from a London university was invited to take part in this study. The response rate was 69.6%, resulting in a final sample of 696 students. The sample comprised 196 (28.2%) males with age range 18 to 61 (M =25.9; SD = 8) and 500 (71.8%) females with age range 18 to 63 (M =24.9; SD =7.8); four males and two females withheld the information about their age. The age and gender composition of the sample is similar to that of two previous studies (Study 1 and Study 2). Participants' demographic characteristics are summarised in Table 14.

The sample consisted of 365 (52.4%) UK nationals, 321 (46.2%) citizens of other countries, and 10 (1.4%) withheld the information about their nationality. Ethnically, participants were 340 (48.9%) White, 106 (15.2%) Black, 64 (9.2%) Asian, 44 (6.3%) of mixed ethnicity, and 142 (20.4%) from other ethnic backgrounds. Participants were from various faculties within the university: 359 (51.6%) from the Faculty of Life Science, 132 (19.1%) from the Business School, 155 (22.2%) from the

Faculty of Social Science and Humanities, 40 (5.7%) from the Faculty of
Law and International Relations, 2 (0.3%) from other faculties, and 8
(1.1%) withheld the information about their subject area.

Table 14: *Summary of Participants' Demographic Characteristics (Study 3).*

Variable	*N*	*%*
Gender		
Male	196	28.2
Female	500	71.8
Faculty		
Life Science	359	51.6
Business School	132	19.1
Social Science and Humanities	155	22.2
Law and International Relations	40	5.7
Other	2	0.3
Unknown	8	1.1
Degree level		
Foundation	96	13.8
1st year	260	37.4
2nd year	98	14.1
3rd year	96	13.8
Postgraduate	138	19.8
Other	8	1.1
Ethnicity		
White	340	48.9
Black	106	15.2
Asian	64	9.2
Mixed	44	6.3
Other	142	20.4
Unknown		
Nationality		
British	365	52.4
Non-British	321	46.2
Unknown	10	1.4

Students were also from different levels of their degree
programmes: 96 (13.8%) were foundation degree students, 260 (37.4%)

were first year undergraduate students, 98 (14.1%) were second year undergraduate students, 138 (13.8%) were third year undergraduate students, 138 (19.8%) were postgraduate students, and 8 (1.1%) reported to be from another level of their university programme.

The data for undergraduate and postgraduate students was analysed together as there was neither theoretical reason nor research evidence suggesting that students at different levels of their degree would differ in cognitive processes associated with creativity. As expected, the t-test of mean differences in use of creative cognition between undergraduate and postgraduate students was non-significant. The comparison between undergraduate and postgraduate students was also made on all other study variables i.e., flow, trait intrinsic motivation, trait extrinsic motivation, positive and negative affect, and all factors of adaptive and maladaptive metacognition. The t-test of mean differences on these study variables between undergraduate and postgraduate students was also non-significant. Conclusively, the two groups of students appear to be very similar.

3.6.2   Measures

Use of Creative Cognition Scale in studying (UCCS) is the 5-item self-reported questionnaire that was developed in a previous study (Study 2). It measures the tendency to deploy creative cognition to problem solving in studying (e.g., "I try to act out potential solutions to explore

their effectiveness" and "I find effective solutions by combining multiple ideas"). The instructions for filling in the questionnaire were: "Following is a series of statements about personal preferences and behaviours. Please indicate how frequently you engage in each behaviour during your study. Please respond thinking of your general studying experience and behaviour across situations and times". Responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The UCCS has retained and modified items from four CPAC facets: Idea Manipulation, Idea Generation, Imagery/Sensory Cognitive Strategy, and Metaphorical/ Analogical Thinking, to form a unidimensional scale.

Short Dispositional Flow Scale-2 (SDFS-2; Jackson, Martin, & Eklund, 2008) is a 9-item scale with each item measuring one of the nine dimensions of flow: dynamic balance between challenge and skill (i.e., "I feel I am competent enough to meet the high demands of the situation"), focused concentration on the present activity (i.e., "I am completely focused on the task at hand"), sense of control over one's actions (i.e., "I have a feeling of total control over what I am doing"), merging of action and awareness (i.e., "I do things spontaneously and automatically without having to think"), clear proximal goals (i.e., "I have a strong sense of what I want to do"), unambiguous feedback (i.e., "I have a good idea while I am performing about how well I am doing"), loss of self-consciousness (i.e., "I am not worried about what others may be thinking of me"), loss of time-awareness or time acceleration (i.e., "The way time

passes seems to be different from normal"), and autotelic experience (i.e., "The experience is extremely rewarding"). The instructions for filling in the questionnaire were: "These questions relate to the thoughts and feelings you may experience during your studying. You may experience these characteristics some of the time, all of the time, or none of the time. Think about how often you experience each characteristic during your studying. Please respond thinking of your general experience and behaviour during your study". Thus, the questionnaire measured flow as a domain-specific disposition. The responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The scale scores were calculated by averaging the responses from all 9 items. The scale displayed satisfactory internal consistency of .77, unidimensional factor structure, and good concurrent validity through positive correlations with dispositional intrinsic motivation, perceived competence, sport self-concept, physical self-concept, general self-concept, and a negative correlation with anxiety (Jackson, Martin, & Eklund, 2008).

Short Flow in Work Scale (SFWS; Moneta, 2012b) is a 3-item scale with each item measuring one of the original components of flow: loss of self-consciousness (i.e., "Sometimes when I am working I become so absorbed that I am less aware of myself and my problems"), focus of attention (i.e., "When I get really involved in my work my concentration becomes like my breathing…I never think of it"), and merging of action and awareness (i.e., "When I am working I am so involved in it that I

don't see myself as separate from what I am doing"). The instructions for filling in the questionnaire were: "Please rate each statement in terms of how true it is of you. Please respond thinking of your general experience and behaviour during your study". Thus, the questionnaire measured flow as a domain-specific disposition. 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 scale scores were calculated by averaging the responses from all three items. The scale had satisfactory internal consistency of .80, correlated with the SDFS-2 flow scale, and had good convergent and discriminant validity through a positive relationship with trait intrinsic motivation and no relationship with trait extrinsic motivation (Moneta, 2012b).

Work Preference Inventory (WPI; Amabile et al., 1994) is a 30-item self-reported scale, of which 15 items measure trait extrinsic motivation and its subscales of compensation (e.g., "I am keenly aware of the goals I have for getting good grades") and outward (e.g., "I prefer having someone set clear goals for me in my work") and 15 measure trait intrinsic motivation and its subscales of challenge (e.g., "The more difficult the problem, the more I enjoy trying to solve it") and enjoyment (e.g., "I want my work to provide me with opportunities for increasing my knowledge and skills"). The instructions for filling in the questionnaire were: "Please rate each statement in terms of how true it is of you. Please respond thinking of your general experience and behaviour

during your study". Thus, the questionnaire measured motivational orientations in the study context. 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 motivations were calculated by averaging the scores of their constituent items. The scale had satisfactory internal consistency of .70 for extrinsic motivation and .75 for intrinsic motivation, and had good concurrent validity through positive correlations with measures of personal development, autonomy, ability utilisation and achievement (Loo, 2001).

International Positive and Negative Affect Schedule - Short Form (I-PANAS-SF; Thompson, 2007) is a list of ten adjectives, five measuring positive affect (e.g., "Attentive") and five measuring negative affect (e.g., "Nervous"). The I-PANAS-SF was derived from the PANAS (Watson et al., 1988), and has retained only unambiguous items and items that can be clearly and uniformly understood by non-native English speakers (Thompson, 2007). The instructions used in this study were: "Please read the following adjectives in detail and think if you have those feelings. Please respond thinking of your current experience and behaviour when you engage in study activities". Adjectives were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The scores for each scale were calculated by averaging the scores of their constituent items. The I-PANAS-SF scores correlated strongly with the PANAS scores, and the

subscales of positive and negative affect showed good 8-week test-retest reliabilities .84 (for both scales), and the good internal consistency of .74 for negative affect and .80 for positive affect (Thompson, 2007).

Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ; Beer & Moneta, 2010) is an 18-item self-reported scale measuring the three adaptive metacognitive traits: Confidence in Extinguishing Perseverative Thoughts and Emotions (e.g., "In times of "feeling in the dumps" it's hard for me to regulate my low mood" (reversed)), Confidence in Interpreting Own Emotions as Cues Restraining from Immediate Reaction, and Mind Setting for Problem Solving (e.g., "I can stop any "negative thinking spirals" and focus on what I can do in the situation"), and Confidence in Setting Flexible and Feasible Hierarchies of Goals (e.g., "I can prioritise my needs and formulate a hierarchy of goals"). The instructions for filling in the questionnaire were: "This questionnaire is concerned with beliefs people have about their thinking and emotions in difficult situations. Listed below are a number of such beliefs that people have expressed. Please read each item and indicate how much you generally agree with it. Please respond thinking of your general experience and behaviour across situations and times". Thus, the questionnaire measured adaptive metacognitions as uncontextualised traits. 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 had good internal consistency in the .80 to .88 range, and good convergent validity through a negative correlation of PMCEQ-1 with maladaptive metacognition and positive correlations of PMCEQ-2 and PMCEQ-3 with trait intrinsic motivation (Beer & Moneta, 2010).

Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) is a 30-item questionnaire measuring the five maladaptive metacognitive traits: Positive Beliefs about Worry (e.g., "Worrying helps me to avoid problems in the future" and "I need to worry in order to remain organised"), Negative Beliefs about Thoughts Concerning Uncontrollability and Danger (e.g., "My worrying is dangerous for me" and "My worrying thoughts persist, no matter how I try to stop them"), Cognitive Confidence (e.g., "My memory can mislead me at times" and "I do not trust my memory"), Beliefs about the Need to Control Thoughts (e.g., "I should be in control of my thoughts all the time" and "If I did not control a worrying thought, and then it happened, it would be my fault"), and Cognitive Self-Consciousness (e.g., "I think a lot about my thoughts" and "I am aware of the way my mind works when I am thinking through a problem"). The instructions for filling in the questionnaire were: "This questionnaire is concerned with beliefs people have about their thinking. Listed below are a number of beliefs people have expressed. Please read each item and indicate how much you generally agree with it. Please respond thinking of your general experience and behaviour across

situations and times". Thus, this questionnaire measured maladaptive metacognitions as uncontextualised traits. 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 had good internal consistency in the range of .72 to .93, and good convergent validity through positive correlations with obsessive-compulsive symptoms, worry, and trait anxiety (Wells & Cartwright-Hatton, 2004).

3.6.3 *Procedure*

Ethics approval for the study was obtained from a university ethics board. The data collection took place throughout the two semesters of the academic year. The data was collected electronically using SurveyMonkey. The invitation letter, information sheet with explanations of the purpose and procedure for the study and the hyperlink to the electronic copy of the questionnaire were sent to students' university e-mail addresses. Access to the survey was conditional to providing informed consent. The data for each participant was anonymised (i.e., link between e-mails and responses was removed) and pulled together with the data from other participants prior to data analysis.

3.6.4 Data analysis

The construct validity of the UCCS was evaluated using confirmatory factor analysis (CFA) of the item scores. Creative cognition was defined as a single latent variable, and the five items of the scale were defined as congeneric indicators of the latent variable. The factor loading of one of its indicators was fixed to 1 in order to fix the scale of the factor. The analysis was conducted in LISREL 8.8 (Jöreskog & Sörbom, 1996) using maximum likelihood (ML) estimation. The fit of the model was evaluated using the following indices, with Hu and Bentler's (1999) cutoff values for close fit: the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI) with the cutoff point of .95, the Standardized Root Mean Square Residual (SRMR) with the cutoff point of .05, and the Root Mean Square Error of Approximation (RMSEA) with the cutoff point of .05. The concurrent and discriminant validity of the UCCS was examined and evaluated using the intercorrelations of the UCCS scores and conceptually related and unrelated scales.

3.7   Results

3.7.1 Assessment of construct validity

The chi-square test of the confirmatory factor model was significant (χ^2= 48.47, df = 5, p < .001), indicating that the model does not fit strictly. However, with reference to Hu and Bentler's (1999) criteria for evaluating goodness of fit, the Comparative Fit Index (CFI =

.97) and the Non-Normed Fit Index (NNFI = .95) exceeded and equalled, respectively, the .95 cutoff point indicating close fit, the Standardized Root Mean Square Residual (SRMR = .038) was less then the cutoff point of .05 indicating close fit, whereas the Root Mean Square Error of Approximation (RMSEA = .078) was greater then the close fit cutoff point of .05 but less than the reasonable fit cutoff point of .08, indicating only acceptable fit. Figure 3 shows the standardized factor loadings and measurement errors of each item. The loadings ranged from .62 to .83, and were similar to those estimated in scale development study using exploratory factor analysis. In all, the findings corroborate the unidimensional factor structure of the scale.
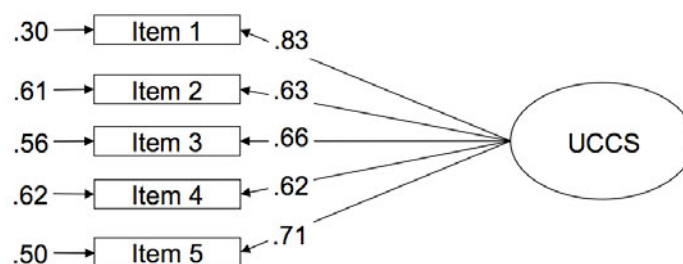
Figure 3: *Standardised factor loadings and measurement errors of the UCCS items estimated using confirmatory factor analysis (CFA).*

3.7.2 Assessment of concurrent and discriminant validity

Table 15 shows the descriptive statistics and intercorrelations of UCCS scores and conceptually related and unrelated scales. The internal consistency of the UCCS was good and virtually identical to the estimate

of Study 2. All other measures had from satisfactory to good internal consistency, with the exception of trait extrinsic motivation, which fell below the threshold of .70 for acceptable internal consistency.

Focusing on concurrent validity, as expected, the UCCS correlated positively with both measures of flow (SDFS-2 and SFWS), trait intrinsic motivation, positive affect, and all three adaptive metacognitive traits (PMCEQ-1 through PMCEQ-3), and it correlated negatively with negative affect. The strongest correlation of the UCCS was with trait intrinsic motivation, followed by those with the SDFS-2 measure of flow, positive affect, and the PMCEQ-3 measure of Confidence in Setting Flexible and Feasible Hierarchies of Goals, in that order.

The findings support all the hypothesised positive relationships, and hence the concurrent validity of the scale. Moreover, the correlations of the UCCS with the other study variables ranged from weak to fair, which indicate that the use of creative cognition in studying as measured by the UCCS is a distinct construct within its nomological network. The UCCS also showed a weak and positive correlation with trait extrinsic motivation, suggesting that students may also engage in creative cognition for extrinsic reasons.

Table 15: *Means, Standard Deviations, Cronbach's alpha (in parentheses) and Correlation Coefficients of the Study Variables (Study3).*

Variable	X	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. UCCS[a]	3.7	.7	(.82)														
2. SDFS-2[a]	3.6	.6	.531**	(.75)													
3. SFWS[b]	2.5	.8	.364**	.448**	(.82)												
4. WPI-IM[b]	2.9	.4	.540**	.540**	.547**	(.80)											
5. WPI-EM[b]	2.7	.4	.199**	.172**	.229**	.167**	(.66)										
6. PA[a]	3.7	.7	.463**	.461**	.264**	.342**	.153**	(.76)									
7. NA[a]	2	.8	-.105**	-.243**	.008	-.102**	.125**	-.164**	(.79)								
8. PMCEQ-1[b]	2.7	.7	.076*	.139**	-.068	.055	-.211**	.163**	-.403**	(.85)							
9. PMCEQ-2[b]	2.5	.6	.356**	.335**	.282**	.367**	-.014	.268**	-.171**	.190**	(.75)						
10. PMCEQ-3[b]	2.8	.7	.438**	.415**	.277**	.382**	.132**	.380**	-.258**	.162**	.683**	(.82)					
11. MCQ-1[b]	2	.8	.049	.001	.15**	.025	.208**	.058	.191**	-.359**	.088*	.095*	(.89)				
12. MCQ-2[b]	2.2	.8	-.014	-.106**	.111**	-.027	.192**	-.061	.405**	-.680**	-.158**	-.136**	.344**	(.86)			
13. MCQ-3[b]	1.9	.7	-.007	-.157**	.084*	-.039	.104**	-.125**	.301**	-.446**	-.052	-.099**	.286**	.462**	(.85)		
14. MCQ-4[b]	2.1	.7	.103**	.052	.158**	.075*	.277**	.035	.264**	-.447**	.154**	.091*	.328**	.488**	.348**	(.76)	
15. MCQ-5[b]	2.74	.66	.249**	.172**	.174**	.239**	.192**	.135**	.110**	-.322**	.279**	.279**	.249**	.397**	.163**	.479**	(.79)

Notes. n = 696. Range of the response scales: [a] 1-5, [b] 1-4. Labels of variables: 1. UCCS = Use of Creative Cognition in Studying; 2. SDFS-2 = Flow; 3. SFWS = Flow; 4. WPI-IM = Intrinsic Motivation; 5. WPI-EM = Extrinsic Motivation; 6. PA = Positive Affect; 7. NA = Negative Affect; 8. PMCEQ-1 = Confidence in Extinguishing Perseverative Thoughts and Emotions; 9. PMCEQ-2 = Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving; 10. PMCEQ-3 = Confidence in Setting Flexible and Feasible Hierarchies of Goals; 11. MCQ-1 = Positive Beliefs about Worry; 12. MCQ-2 = Negative Beliefs about Thoughts Concerning Uncontrollability and Danger; 13. MCQ-3 = Cognitive Confidence (lack of); 14. MCQ-4 = Beliefs about the Need to Control Thoughts; 15. MCQ-5 = Cognitive Self-Consciousness.

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

Finally, turning attention to discriminant validity, the UCCS did not correlate with three out of five maladaptive metacognitive traits. However, the UCCS had weak and unexpectedly positive correlations with two maladaptive metacognitive traits: Cognitive Self-Consciousness and Need to Control Thoughts. As such, hypothesis 3.5 only partly supported. In sum, the UCCS has discriminant validity relative to core maladaptive metacognitive traits, but it converges weakly with other two, and the processes underlying the associations need to be investigated.

3.8   Discussion

The present study reported development and validation of the Use of Creative Cognition Scale (UCCS) in studying, a handy scale designed to measure university students' use of creative cognition while engaged in study activities. Study 2 assessed the factor structure of an abridged, 21-item CPAC scale (Miller, 2009), which was expected to measure the four factors of Idea Manipulation, Imagery/Sensory Cognitive Strategy, Metaphorical/Analogical Thinking, and Idea Generation Cognitive Strategy, on a large student sample. Exploratory factor analysis indicated, firstly, that the proposed four-factor structure did not hold, and secondly, that the scale is a unidimentional instrument. Moreover, the relatively small variance accounted for by a single factor suggested that item reduction was an appropriate step in the scale development process. Finally, five items were selected from the scale based on statistical and

conceptual considerations to create the five-item unidimensional UCCS. Exploratory factor analysis suggested that the UCCS is a unidimentional instrument, and the scale displayed good internal consistency.

Study 3 examined the construct, concurrent, and discriminant validity of the UCCS on a different and large student sample that also completed a set of scales measuring conceptually related and unrelated variables. Confirmatory factor analysis supported the unidimentional structure of the UCCS. The scale also had good internal consistency, almost identical to that estimated in Study 2. Finally, the UCCS displayed good concurrent validity through correlations with measures of related constructs, and acceptable discriminant validity through the absence of the relationships with measures of conceptually unrelated constructs.

Creative cognition is largely under-researched in comparison with other types of creativity (i.e., "person", "product" and "press" creativity) in its relationships with other psychological constructs. Therefore, the assessment of the concurrent validity of the UCCS required actively looking for relationships. A set of expected relationships was grounded in prior theoretical and empirical research.

First, the UCCS showed weak to moderate positive relationships with two measures of flow, consistent with the notion that flow and creativity are related but distinct constructs (Csikszentmihalyi, 1997). Second, the UCCS correlated moderately and positively with trait intrinsic motivation and weakly and positively with trait extrinsic

motivation. These findings are consistent with the idea that intrinsic motivation fosters creativity and that also extrinsic motivation may do so, but to a lesser extent and only in some contexts and endeavours (Amabile, 1996). Finally, the UCCS showed a moderate and positive relationship with positive affect and a weak and negative relationship with negative affect. These findings are in line with a large body of empirical research showing that positive affect enhances cognitive performance (Ashby, Isen, & Turken, 1999) and, in particular, problem solving in everyday life situations (Vosburg, 1998), whereas negative affect hinders cognitive performance (Christodoulou et al., 2009; Gasper & Clore, 2002).

The relationship between the tendency to use creative cognition and adaptive metacognitive traits (Beer & Moneta, 2010) was explored for the first time. The UCCS correlated very weakly and positively with Confidence in Extinguishing Perseverative Thoughts and Emotions, weakly and positively with Confidence in Interpreting Own Emotions as Cues, Restraining from Immediate Reaction, and Mind Setting for Problem Solving, and moderately and positively with Confidence in Setting Flexible and Feasible Hierarchies of Goals. These findings suggest that students who possess higher levels of adaptive metacognitive traits tend to use more creative cognition.

These results also are broadly consistent with the notion that metacognition plays an important role in creative problem solving (Antonietti et al., 2000). In particular, the findings suggest that the ability

to remain self-reflective in times of experiencing strong and changeable emotions and to exercise self-regulation when cognitive activity and behaviour should be directed towards the accomplishment of the task at hand facilitating the use of cognitive strategies leading to creativity.

The discriminant validity of the UCCS was examined in relation to the construct of maladaptive metacognition, which was previously found to explain maladaptive learning processes and not to explain adaptive learning processes. The UCCS showed no relationship with three core maladaptive metacognitive traits, which substantially supports the discriminant validity of the scale. However there was a weak and positive correlation between the UCCS scores and Cognitive Self-Consciousness, and Need to Control Thoughts.

These associations are not necessarily evidence of the lack of discriminant validity, as both maladaptive metacognitive traits correlated positively with other adaptive variables such as flow, trait intrinsic motivation, and the adaptive metacognitive trait of Confidence in Setting Flexible and Feasible Hierarchies of Goals. Therefore, it is possible that these metacognitive traits are not altogether maladaptive. In particular, Cognitive Self-Consciousness relates to the capacity to observe one's own internal states. Hence it may bring awareness of one's failure in achieving a learning objective and of the need to engage in creative cognition in order to make progress toward the learning goal. Moreover, Need to Control Thoughts relates to the capacity to refrain from

"automatic pilot". As such, it may facilitate a shift from routine cognition to creative cognition when needed. In sum, the discriminant validity of the scale is supported but it needs to be investigated with reference to a larger number of variables.

In relation to the scale development there are four important limitations that should be addressed in future research. First, both the CPAC scale and the UCCS have not yet been tested for temporal stability; so that, it is not possible to estimate the potential for change that an intervention study aimed at enhancing "process" creativity may have. Second, the extent to which the UCCS and the original CPAC scale converge could not be assessed in Study 3 because the latter was not included in the online survey. As such, there is uncertainty as to whether the two scales measure the same or somewhat distinct constructs. Thirdly, all items in the scale are positively worded, which can lead to response bias and acquiescent bias. Therefore, future scale development research should consider altering some items to make them negatively worded, which will help to reduce these biases. Furthermore, one item in the UCCS that was not altered in any way from the CPAC scale is measuring a belief rather than behaviour (i.e., "Incorporating previous solutions in new ways leads to good ideas"). The factor analysis of the whole set of items forming the scale showed that participants have interpreted it as a question about their behaviour, nevertheless, the scale will benefit from altering this item to measure one's behaviour. Finally, this study assessed

the use of creative cognition during study activities; so that, the findings do not generalise to other contexts of activity and other non-student populations such as workers. Therefore, future research should re-assess the psychometric properties of the scale on the contexts of activity.

Overall, the UCCS measures a distinct construct within its monological network and provides a concise, unidimensional measure of students' use of creative cognition in studying. It should be chosen when researchers are interested in measuring the overall use of creative cognition, rather than the use of specific cognitive processes associated with creativity. The development of UCCS scale at last enables the examination of the relationship between the use of creative cognition in studying and positive affect in studying, which was shown to be the strongest psychological correlate of students' academic performance. It also enables investigations into the importance of the tendency to use creative thinking strategies for better learning.

CHAPTER 4 – STUDY 4

Use of Creative Cognition and Positive Affect in Studying: Evidence

of a Reciprocal Relationship

Abstract

This two-wave study examined the longitudinal relationships between positive affect in studying and the frequency of 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 behaviour, and the self-determination theory, it was hypothesised 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 the 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.

4.1   Introduction

The main finding of Study 1 was that positive affect explained higher students' academic performance and that the relationship held even when controlling for the effect of prior compatible academic performance. Moreover, positive affect in studying has been found to be a stronger correlate of academic performance than negative affect, evaluation anxiety, and deep, surface, and strategic approaches to studying (Study 1). Based on the results of Study 1 positive affect should be considered a primary variable for intervention.

However, positive affect is hard to stimulate directly because individual's responses to the situations and an individual's sensitivity to the emotive stimulus is determined by temperament (Clark & Watson, 1999). As such, everyone's affective response to the emotive stimuli is inbred (Rothbart, Ahadi, & Evans, 2000). Furthermore, despite the variation in the emotional responses to the different emotional stimuli, the overall emotional experience is rather stable over time (Watson & Walker, 1996), meaning that each student will have a tendency to feel either positive or negative emotions across situations and times despite situational dissimilarities.

Consequently, it is important to understand what factors influence positive affect in studying. This study proposes that the use of creative cognition in studying i.e., the tendency to deploy one's creative ability to

an achievement context, may be a factor that is enhanced by, and enhances, positive affect in studying.

4.1.1   Positive affect as a facilitator of the use of creative cognition

The facilitative effect of positive affect on creativity has been extensively researched. Experimentally induced positive mood overall has been found to result in more flexible (Hirt, 1999; Hirt et al., 1997) and inclusive (Isen & Daubman, 1984) categorisation of information, more unusual word associations (Isen et al., 1985), better problem solving (Isen et al., 1987), more cognitive flexibility (Hirt et al., 2008) and more divergent thinking (Vosburg, 1998), which are all characteristics of creative thinking. 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 and strengthened by field studies conducted on workers in their occupational settings. In a pivotal study, the positive affect and self-rated creative thought of the workday (which can be regarded as a general indicator of use of creative cognition) of 222 employees and supervisors, who were working on 26 challenging team projects in seven companies. The creative thoughts of the day were measured using an end-of-day diary until completion of the team projects (Amabile et al., 2005). Projects lasted from nine to 38 weeks, with an average of 19 weeks. Multilevel time-lagged analyses

revealed that positive affect on any given workday explained creative thought on the same day as well as on the following two days.

The relationship between positive affect and self-rated creativity at work has been also corroborated in a field study on 116 workers from a wide range of occupations in which employees' positive affect at work was measured at the beginning and end of each workday and self-rated creativity at work was measured at the end of each workday for a week (Bledow, Rosing, & Frese, 2013). Therefore, 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 endeavours that may last for several 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). The theory posits that positive emotions expand one's attention (Gasper & Clore, 2002), cognition (Fredrickson & Joiner, 2002) and thought-action repertoires (Johnson & Fredrickson, 2005). Moreover, the theory regards positive affect as a promoter of specific emotions, such as enjoyment of, and interest in an activity, which in turn leads one to use the broadened thought-action repertoires for playing and exploring. Insofar as play and exploration require the use of creative cognition, the theory entails that, if the task at hand allows creativity and the individual has sufficient creative ability

and task-relevant skills, positive affect will foster both the use of creative cognition and creative performance in the task.

The *mood-as-input* model (Martin et al., 1993) complements the broaden-and-build theory by making predictions on the quality and duration of task engagement. Hence, when people are in a positive mood and believe that their mood is a sign that they are enjoying the activity, they are more likely to process information deeply and systematically and hence persist longer in the activity. As such, insofar as positive affect fosters broadening of cognition and enjoyment of the activity as posited by the broaden-and-build theory, people when in a state of high positive affect will be more likely to deploy their creative cognition to the task and they will do it for longer. Therefore, the broaden-and-build theory (Fredrickson, 1998, 2001) and the mood-as-input model (Martin et al., 1993) in combination entail that positive affect in studying will facilitate the activation and prolonged use of creative cognition in studying.

4.1.2   Use of creative cognition as a facilitator of positive affect

The review of a literature indicated that positive affect prospectively relates to creativity however, little is known about influence of creative thinking on positive affect. A notable exception is represented by Amabile and co-workers' (2005) longitudinal diary study of team project work in organisations. They tested for lagged effects of self-rated creative thought of the workday on positive affect of the workday and

found none. This suggests that creative thinking has no emotional impact beyond the workday in which it occurred.

However, Amabile et al. (2005) found evidence of lagged effects in a qualitative analysis of free open-ended descriptions of the workday. They identified 364 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 pride and relief. Nevertheless, these positive emotions were often offset by unfavourable feedback from supervisors and peers. These findings overall suggest that the emotional consequences of creative thinking are difficult to tap because they 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 overall task-inherent emotional consequences of the use of creative cognition can be inferred from the *control-process* model of self-regulation of intentional behaviour (Carver & Scheier, 1990, 2000). Applying the theory to the use of creative cognition in studying it is expected that students who deploy their creative thinking abilities in studying will learn better and progress faster in studying. As a result they will experience positive affect. Therefore, insofar as the use of creative

cognition accelerates progression toward the goal, positive affect will increase.

More indirect emotional consequences of the tendency to use creative cognition can be inferred from *self-determination* theory (Deci & Ryan, 1985; Ryan & Deci, 2000). The theory posits that humans are "[…] active, growth-oriented organisms, that innately seek and engage challenges in their environment, attempting to actualise their potentialities, capacities and sensibilities" (Ryan & Deci, 2004, p. 8).

The goal-oriented behaviour can occur at various levels of the self-determination continuum. Each level of self-determination occurs in correspondence with a *locus of causation* (i.e., the interpretation of the origins of one's own behaviour; DeCharms, 1968). The locus of causation is impersonal when there is no self-determination, external for low levels of self-determination, and internal for high levels of self-determination. As such, self-determination provides individuals with a sense of personal causation, agency, and control. It is empowering, and typically results in heightened intrinsic motivation, which is accompanied by the emotions of enjoyment of, and interest in the activity.

The self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000) further posits that an individual's level of self-determination in any given task depends both on environmental (e.g., an open minded and supportive work environment) and personal factors (e.g., a history of successful engagement in similar tasks or a strong autonomy orientation).

It follows that, if people freely decide to use their creative cognition in delving into an endeavour, they will tend to be more intrinsically motivated, will enjoy more the activity, and hence will be more likely to experience a heightened positive affect throughout and after the endeavour.

Based on the reviewed empirical evidence and proposed theoretical arguments, this study proposes that using creative cognition in studying may be a factor that is enhanced by, and can enhance positive affect in studying. The aim of this study therefore, is to investigate the longitudinal relationships between positive affect and the use of creative cognition in the domain of studying, using a two-wave (semester 1, semester 2) study design. Therefore the following two hypotheses are posited:

H 4.1   *Positive affect in studying in semester 1 will be positively associated with semester 2 use of creative cognition in studying.*

H 4.2   *Use of creative cognition in studying in semester 1 will be positively associated with semester 2 positive affect in studying.*

Figure 4 presents the hypotheses as a reciprocal path model. Hypothesis 4.1 is represented by the arrow from semester 1 positive affect to semester 2 use of creative cognition, whereas hypothesis 4.2 is

represented by the arrow from semester 1 use of creative cognition to semester 2 positive affect. The arrows from semester 1 positive affect to semester 2 positive affect and from semester 1 use of creative cognition to semester 2 use of creative cognition represent temporal stabilities of the study variables that need to be controlled for in the analysis together with random measurement error and systematic measurement method bias.
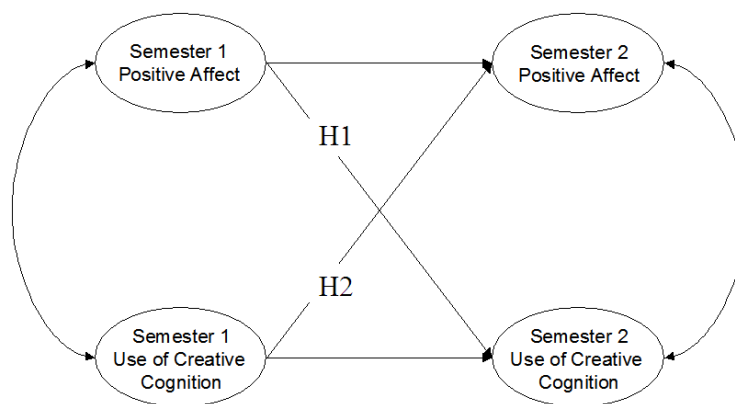
Figure 4: *The hypothesised reciprocal positive affect – use of creative cognition model stating that (H 4.1) semester 1 positive affect longitudinally correlates with semester 2 use of creative cognition, and (H 4.2) semester 1 use of creative cognition longitudinally correlates with semester 2 positive affect, while accounting for the individual stability of positive affect and the use of creative cognition over consecutive semesters.*

4.2   Method

4.2.1 Participants

An opportunity sample of 200 students from a London university was invited to take part in this study. The response rate was 74%,

resulting in a sample of 148 students in this two-wave study. Only 130 participants completed both waves of data collection and were retained for the analysis. The results of a series of t-tests showed that there was no difference between dropouts and a final sample in their levels of positive affect and the frequency of use of creative cognition in semester 1 (first wave). Participants' demographic characteristics are summarised in Table 16.

Table 16: *Summary of Participants' Demographic Characteristics (Study 4).*

Variable	N	%
Gender		
Male	30	23.1
Female	100	76.9
Faculty		
Life Science	70	53.8
Business School	23	17.7
Social Science and Humanities	20	15.4
Law and International Relations	10	7.7
Other	7	5.4
Degree level		
Foundation	12	9.2
1st year	49	37.7
2nd year	24	18.5
3rd year	17	13.1
Postgraduate	25	19.2
Unknown	3	2.3
Ethnicity		
White	70	53.9
Black	18	13.8
Asian	27	20.8
Mixed	9	6.9
Other	4	3.1
Unknown	2	1.5
Nationality		
British	73	56.2
Non-British	54	41.5
Unknown	3	2.3

The sample consisted of 30 (23.1%) males with age range 18 to 48 (*M* = 24.5; *SD* = 6.4) and 100 (76.9%) females with age range 18 to 52 (*M* = 25.1; SD = 7.6). The age and gender composition of the sample is similar to that of Study 1, 2 and 3, suggesting that the study sample is representative of the university's population. There were 70 (53.8%) students from the Faculty of Life Science, 23 (17.7%) students from the Business School, 20 (15.4%) students from the Faculty of Social Science and Humanities, 10 (7.7%) students from the Faculty of Law and International Relations, and 7 (5.4%) from other faculties. Twelve (9.2%) were foundation degree students, 49 (37.7%) first year undergraduate students, 24 (18.5%) second year undergraduate students, 17 (13.1%) third year undergraduate students, 25 (19.2%) postgraduate students, and 3 (2.3%) students withheld information about their level of studying. There were 70 (53.9%) Whites, 18 (13.8%) Blacks, 27 (20.8%) Asians, 9 (6.9%) of mixed ethnicity, 4 (3.1%) from other ethnic background, and 2 (1.5%) participants who withheld information about their ethnicity; and 73 (56.2%) were British nationals, 54 (41.5%) non-British nationals, and 3 (2.3%) participants who did not report their nationality.

4.2.2 Measures

Use of Creative Cognition Scale (UCCS) in Studying (Study 2 and 3). This questionnaire was developed in Study 2 and validated in Study 3. The UCCS is a 5-item self-reported questionnaire measuring the tendency

to deploy creative cognition to problem solving in studying (e.g., "I try to act out potential solutions to explore their effectiveness" and "I find effective solutions by combining multiple ideas"). The instructions for filling in the questionnaire were: "Following is a series of statements about personal preferences and behaviours. Please indicate how frequently you engage in each behaviour during your study. Please respond thinking of your general studying experience and behaviour across situations and times". Responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The UCCS has retained and modified 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 score for the scale was calculated by averaging the scores of their constituent items. The test-retest reliability of the UCCS has not yet been estimated, whereas the internal consistency in the original validation study was .82. The scale showed good concurrent validity through positive correlations with flow in studying, adaptive metacognitive traits, and trait intrinsic motivation (Study 2 & 3).

Positive and Negative Affect Schedule (PANAS) – Short Form (I-PANAS-SF; Thompson, 2007) is a list of ten adjectives, five measuring positive affect (e.g., "Attentive") and five measuring negative affect (e.g., "Nervous"). The I-PANAS-SF was derived from the PANAS (Watson et al., 1988), and has retained only unambiguous items and items that can be

clearly and uniformly understood by non-native English speakers (Thomson, 2007). The instructions used in this study were: "Please read the following adjectives in detail and think if you have those feelings. Please respond thinking of your current experience and behaviour when you engage in study activities". Adjectives were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The scores for each scale were calculated by averaging the scores of their constituent items. The I-PANAS-SF scores correlated strongly with the PANAS scores, and the subscales of positive and negative affect showed good 8-week test-retest reliabilities .84 (for both scales), and the good internal consistency of .74 for negative affect and .80 for positive affect (Thompson, 2007).

4.2.3 Procedure

Ethics approval for the study was obtained from a university ethics board. The data were collected electronically using SurveyMonkey in semester 1 (first wave) and semester 2 (second wave) of an academic year. The invitation letter, information sheet with explanations of the purpose of the study and its procedures and the hyperlink to the survey were sent to students' university e-mail addresses. Access to the survey was conditional on providing informed consent. The survey for the second wave of data collection was send only to the participants who responded in the first wave. In order to keep the drop out rate low, two reminder e-mails were send to those students who did not fill in

questionnaire during the second wave of data collection within a week of the second wave invitation (one reminder per week). The semester 1 and semester 2 questionnaire responses were allied together using participants' e-mail addresses. The data for each participant was anonymised (i.e., link between e-mails and responses was removed) and pulled together with the data from other participants prior to data analysis.

4.2.3 Data analysis

The analysis evaluated the proposed hypothetical model by comparing its fit to the data with that of the alternative models. The hypothesised and alternative models were tested using structural equation modelling as implemented in LISREL 8.8 (Jöreskog & Sörbom, 1996). In all models, semester 1 positive affect, semester 2 positive affect, semester 1 use of creative cognition, and semester 2 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 hypothesised 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. This model explains change in positive affect and use of creative cognition merely in terms of inherent temporal stability of the measures, random error, and method bias. Therefore, the stability model does not hypothesise the longitudinal cross-lagged relationships between positive affect and the frequency of use of creative cognition.

The *cross-lagged model 1* (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 models tests hypothesis 4.1 controlling for temporal stabilities.

The *cross-lagged model 2* (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. As such, this models tests hypothesis 4.2 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. Therefore, this model tests simultaneously hypothesis 4.1 and hypothesis 4.2 controlling for temporal stabilities.

The four models were compared by means of the chi-square difference test (Jöreskog & Sörbom, 1996). The fit for each model was evaluated using the following indices with Hu and Bentler's (1999) cutoff values for close fit: the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI) with the cutoff point of .95, the Standardized Root Mean Square Residual (SRMR) with the cutoff point of .05, and the Root Mean Square Error of Approximation (RMSEA) with the cutoff point of .05.

4.3 Results

4.3.1 Descriptive statistics

The means, standard deviations, correlations coefficients, and Cronbach's alpha coefficients of the study variables are presented in Table 17. Both scales measuring positive affect and the use of creative cognition had satisfactory internal consistency above .70 at both measuring points. They also had fair one-semester test-retest reliabilities exceeding .50. The contingent correlations between positive affect and the use of creative cognition were moderate and similar to Study 3 results.

Table 17: *Means, Standard Deviations, Correlation Coefficients, and*
Cronbach's alpha Coefficients (in parentheses) of the Study
Variables (Study 4).

Variable	X	SD	1.	2.	3.	4.
Semester 1						
1. Positive Affect	3.7	0.7	(.74)			
2. Creative Cognition	3.7	0.7	.467[**]	(.82)		
Semester 2						
3. Positive Affect	3.7	0.7	.506[**]	.433[**]	(.78)	
4. Creative Cognition	3.8	0.8	.445[**]	.601[**]	.528[**]	(.89)

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

The cross-lagged correlations between positive affect and the use of creative cognition were moderate and in line with the Study 3 findings. The cross-lagged correlations between positive affect and the use of creative cognition are consistent with both hypothesis 4.1 and hypothesis 4.2.

4.3.2   Model testing

The goodness-of-fit indices of all four competing models are presented in Table 18. 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 cross-lagged model 1 (Model 2) was superior to the stability model (Model 1) (Delta $\chi^2(1) = 5.3$, $p = .021$).

This implies that the cross-lagged path from semester 1 positive affect to semester 2 use of creative cognition is significant. The cross-lagged model 2 (Model 3) failed by a small margin to outperform the stability model (Model 1) (Delta $\chi^2(1) = 3.8$, $p = .051$). This infers that the cross-lagged path from semester 1 use of creative cognition to semester 2 positive affect is 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 cross-lagged model 1 (Model 2) (Delta $\chi^2(1) = 4.37$, p $= .037$), and the cross-lagged model 2 (Model 3) (Delta $\chi^2(1) = 5.87$, $p = .015$). This entails 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 are significant. In all, the hypothesised reciprocal model (Model 4) is the best fitting of the four models.

Table 18: *Goodness-of-fit Indices for the Alternative Positive Affect – Use of Creative Cognition Models (Study 4).*

Model	χ^2	df	p	RMSEA	CFI	NNFI	SRMR
Model 1: Stability model	218.32	157	.001	.055	.97	.96	.095
Model 2: Cross-lagged model 1	213.02	156	.002	.053	.97	.97	.083
Model 3: Cross-lagged model 2	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 5 shows the estimated reciprocal model with standardised 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. As such, the hypotheses 4.1 and 4.2 are supported.
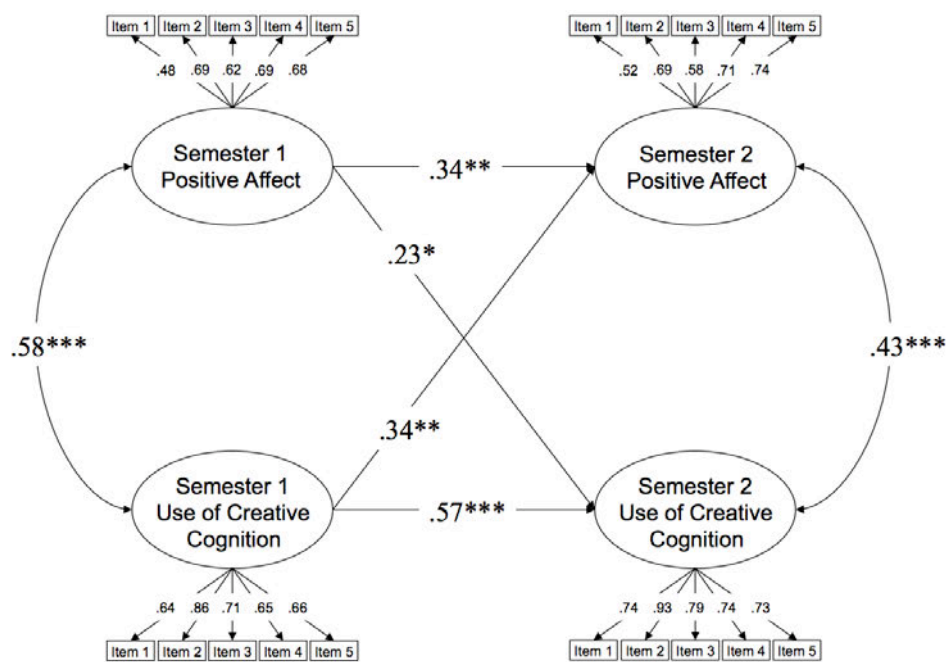
* $p < .05$ (1-tailed); ** $p < .01$ (1-tailed); *** $p < .001$ (1-tailed).

Figure 5: *The estimated reciprocal positive affect – use of creative cognition model with standardised path coefficients and latent variables factor loadings*.

4.4   Discussion

This two-wave study examined longitudinally the relationship between positive affect in studying and the frequency of use of creative cognition in studying in a sample of university students. A review of prior empirical studies and theoretical arguments indicated that the use of creative cognition should be both an antecedent and a consequence of positive affect. It was hypothesised that semester 1 positive affect will facilitate semester 2 use of creative cognition and semester 1 use of creative cognition will facilitate semester 2 positive affect.

Structural equation modelling revealed that the reciprocal model (including two cross-lagged paths from semester 1 positive affect to semester 2 use of creative cognition and from semester 1 use of creative cognition to semester 2 positive affect) had a close fit to the data, and fitted better than the stability model (including no cross-lagged path), the cross-lagged model 1 (including one cross-lagged path from semester 1 positive affect to semester 2 use of creative cognition), and the cross-lagged model 2 (including one cross-lagged path from semester 1 use of creative cognition to semester 2 positive affect). These findings support both hypotheses and suggest that positive affect in studying and the use of creative cognition in studying have reciprocal longitudinal relationships.

These relationships can be interpreted with reference to well-established theories and models. On the one hand, the longitudinal relationship between positive affect and the use of creative cognition is

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 would entail that students who experience more positive emotions in studying build and broaden their attention and thought-action repertoires, tend to consider the learning tasks more enjoyable, and hence use their creative cognition in studying more intensely and frequently.

On the other hand, the longitudinal relationship between the use of creative cognition and positive affect is consistent with the control-process model of self-regulation of intentional behaviour (Carver & Scheier, 1990, 2000), which would predict that students who use more creative cognition in studying make faster progress in learning and hence experience positive affect. Moreover, the relationship is consistent with the self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000), which would predict that the choice to engage creatively with learning tasks empowers students and enhances their self-determination and intrinsic task-motivation, and hence results in heightened positive affect throughout the endeavour and thereafter.

There is an asymmetry between the two longitudinal 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 organisational 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 particular, Amabile and co-workers' (2005) longitudinal diary study of team project work in organisations found qualitative support, but did not find quantitative support for the existence of the relationship. As such, the finding that this relationship holds for students in university settings is an important addition to knowledge. However, it 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 in numerous environmental factors. Nevertheless, Amabile and co-workers' (2005) qualitative analysis suggests a plausible and seemingly simple explanation for the existence of the use of creative cognition – positive affect relationship in study settings and for its absence in at least certain work settings. Thus, for the challenging team project work investigated by Amabile and co-workers (2005), creativity was both possible and desirable, at least from the management perspective. 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 envious or competing others).

Contrastingly, the present study's sample was made of students from a university that does not explicitly consider creativity in its marking criteria. This makes creative performance essentially non-normative, optional, and virtually risk-free, as in the worst-case scenario markers would just ignore the creativity expressed in academic examinations and coursework. As such, it is likely that the successful use of creative cognition was followed only 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 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 results of this study have to be considered in the light of three key limitations. First, 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. Second, a two-wave longitudinal design can suggest causality, but does not allow claiming causality. This is particularly the case for a reciprocal model, as a third, unmeasured variable might be 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.

Relevant to the last key limitation, 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 use of creative cognition, which in its 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 use of creative cognition, which might further decrease positive affect, and hence a downward spiral of negativity would be created. 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 randomised trial design with sufficiently long follow-up time and numerous repeated measurement points.

Despite its limitations, the present study is the first to establish the reciprocal relationship between positive affect and the use of creative cognition in educational settings. As such, it provides a preliminary framework for designing interventions aimed at improving students' positive affect in studying by stimulating their use of creative cognition in studying. The strength of the relationships observed between the frequency of use of creative cognition in both semesters compared to that observed between positive affect in two semesters suggests relative

stability and further advances this Ph.D. research towards the development of a comprehensive model of academic performance.

CHAPTER 5 – STUDY 5

The Chained Mediation Model of Academic Performance in Higher

Education

Abstract

Current study proposed and tested a chained mediation model of academic performance that comprised of two submodels i.e., adaptive-positive and maladaptive-negative submodels. The hypothesised model proposed that trait intrinsic motivation and adaptive metacognition would facilitate students' use of creative cognition (first-level mediator), positive affect and deep and strategic approaches to studying (second-level mediator), which would lead to higher academic performance. In contrast trait extrinsic motivation and maladaptive metacognition would lead to elevated levels of evaluation anxiety (first-level mediator), negative affect and the surface approach to studying (second-level mediator), which would undermine academic performance. The model was tested using a sample of 373 university students. The proposed model explained 90% of variance in academic performance with prior academic performance and positive affect in studying being the only significant correlates of students' academic performance.

5.1   Introduction

Currently the majority of university students' support schemes are centred around the development of students' academic skills and competences and there is an absence of programmes that intervene on psychological correlates of learning. One of the reasons for this is the lack of a comprehensive model of learning, which would incorporate psychological variables that both undermine and facilitate learning. This study aims to develop and test such a model, which would provide an empirical foundation for designing effective educational interventions/programmes. The proposed chained mediation model of academic performance is based on the findings from Studies 1 to 4 of this Ph.D. research as well as on the findings from other empirical studies and psychological theories discussed in the literature review and introduction sections to each study.

5.1.1   *Processes that correlate with academic performance*

From the personality and individual differences perspective psychological variables can be viewed either as structures or as processes. Variables that signify the variability of behaviour within a person are referred to as processes i.e., process approach describes how an individual differentially behaves and reacts to situations and environment (Fleeson, 2001; McAdams, 1995; Pervin, 1994). Based on the theory, variable characteristics, variable stability and domain dependence; approaches to

studying, positive and negative affect, the use of creative cognition and evaluation anxiety were defined as processes.

According to SAL theory (Entwistle, Hanley, & Hounsell, 1979) approaches to studying are individual differences in cognitive-behavioural tendencies towards studying. They are developed as a result of prior learning experience, personality characteristics and levels of cognitive ability, and are also influenced by environment and behavioural motives. Therefore, approaches to studying can be changed/learned.

The empirical evidence is consistent with the theoretical conception of approaches to studying in that research found that students' approaches to studying change as a result of change in educational environment, particularly assessments (e.g., Kember & Gow, 1994; Marton & Säljö, 1976), or following study skills interventions (Norton & Crowley, 1995; Solomonides & Swannel, 1995). Therefore, approaches to studying can be seen as psychological processes.

Even though in Study 1 approaches to studying failed to explain students' academic performance when statistically controlling for prior academic performance and affect in studying, the overall literature review suggested that there is a meaningful relationship between the two. As such, the predictive validity of approaches to studying needed to be further tested in the model of academic performance. It was hypothesised that:

H 5.1   *(a) Strategic and (b) deep approaches to studying will positively correlate with academic performance, whereas (c) the surface approach to studying will negatively correlate with academic performance.*

Another important process in learning is positive and negative affect. Positive and negative affect students experience in studying in relation to various aspects of studying, and moderate strength of the correlation between positive affect measured in two sequential semesters (Study 4) indicates that affect in studying is a process. In relation to academic performance, there is an overall consensus that positive affect explains higher academic performance and negative affect explains lower academic performance (e.g., Artino et al., 2010; Dosseville et al., 2012; Study 1). Therefore, it was hypothesised that:

H 5.2   *(a) Positive affect in studying will positively correlate with academic performance, whereas (b) negative affect in studying will negatively correlate with academic performance.*

Creativity was also identified as an important process in learning and showed a strong and consistent relationship with positive affect (e.g., Baas, De Dreu, & Nijstad, 2008; Isen, Daubman, & Nowicki, 1987). Study 4 was the first one to find a reciprocal relationship between the use

of creative cognition and positive affect. Even though the use of creative cognition can be both an antecedent and a consequence of positive affect, based on the stability of the use of creative cognition over time (Study 4), and on the well-established relationship between positive affect and academic performance, the use of creative cognition was tested as a first-level mediator explaining positive affect in studying.

The relationship between the use of creative cognition and approaches to studying has not yet been investigated. However, it is expected that the frequency of use of creative cognition will 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), can be seen as prerequisites for enabling deep information processing. By the same token, visualisation strategy, which is essentially an ability to voluntary construct internal images (Daniels-McGhee & Davis, 1994), enables better understanding of ideas and seeing interrelationships between ideas, which would assist in deeper information processing. As such, the tendency to use creative cognition in studying should facilitate the adoption of adaptive approaches to studying (i.e., deep and strategic approaches). Therefore, it was hypothesised that:

H 5.3   The use of creative cognition will positively correlate with (a) positive affect in studying, and (b) strategic and (c) deep approaches to studying.

The undermining effect of evaluation anxiety is, in some way, oppositional to the facilitative effect of the use of creative cognition on learning. Evaluation anxiety is regarded, in some cases, as an individual predisposition to feel anxious in evaluative situations whereas, in other instances, it refers to fluctuation in levels of anxiety in evaluative situations. Either way, the manner in which evaluation anxiety is measured determines whether trait or state evaluation anxiety is assessed. For the purpose of constructing a model of academic performance, evaluation anxiety was measured as a process and assessed in the domain of studying.

Evaluation anxiety and its different sub-forms were found to undermine cognitive efficiency (particularly attention and working memory) and academic performance (see review by Zeidner, 1998) as well as predispose students to adopt the surface approach to studying (e.g., Cermakova, Moneta, & Spada, 2010; Moneta, Spada, & Rost, 2007). Furthermore, general trait and state anxiety were found to strongly and positively correlate with negative affect (e.g., Clark, Watson, & Mineka, 1994; Clark & Watson, 1991) and test-anxious students showed on average higher levels of negative emotions, particularly shame and

guilt (Arkin et al., 1982; Stowell et al., 2008). Therefore, it was hypothesised that:

H 5.4   Evaluation anxiety will positively correlate with (a) the surface approach to studying and with (b) negative affect in studying.

5.1.2   Structures that correlate with processes

The variability of behaviour within a person (process) depends on what the person is like i.e., on structures. Structures are variables that signify the similarity of an individual's behaviour across situations and times i.e., structural approach emphasises the "mean" behaviour (Fleeson, 2001; McAdams, 1995; Pervin, 1994).

One of the important structures in learning is motivation. Motivation is a driving force of one's behaviour and represents a structure when conceptualised as an individual predisposition to be more intrinsically or extrinsically motivated across situations and times (Amabile et al., 1994). Trait intrinsic motivation is mainly defined by preference for challenging tasks and striving for mastery and learning that are guided by curiosity and interest. Trait extrinsic motivation on the other hand is defined by engagement with an activity because of rewards, recognition and dictates of others (Amabile et al., 1994).

Based on characteristics of trait intrinsic motivation, strive for mastery in learning and enjoyment gained from understanding complex

material will facilitate the deep approach to studying, whereas drive for external reward attainment and dictates of others will encourage students to learn information that is required to avoid failure and will facilitate the surface approach to studying. Trait extrinsic motivation is also expected to positively correlate with the strategic approach to studying, as it is primarily guided by desire to obtain best possible grade. However, if external reward is internalised and perceived as mean to an engagement (i.e., feedback) it does not undermine intrinsic motivation (e.g., Amabile, Hill, Hennessey, & Tighe, 1994; Hennessey, Amabile, & Martinage, 1989). Therefore, trait intrinsic motivation can also facilitate the strategic approach to studying.

Research indeed supported the positive relationship between trait intrinsic motivation and deep and strategic approaches to studying, and the positive relationship between trait extrinsic motivation and the surface approach to studying (e.g., Moneta & Spada, 2009; Spada & Moneta, 2012). However, it is important to acknowledge that both trait extrinsic and intrinsic motivation can positively correlate with the strategic approach to studying. As such, the relationship between trait intrinsic and extrinsic motivation and the strategic approach to studying is more complex than that with deep and surface approaches to studying and therefore, it should be researched independently before any modelling can take place.

Trait intrinsic motivation was also found to explain creative output (e.g., collage) (e.g., Amabile, Hennessey, & Grossman, 1986; Hennessey et al., 1989) and to positively correlate with the tendency to use creative cognitive strategies in studying (Study 3). Trait extrinsic motivation in contrast was found to explain elevated levels of evaluation anxiety (Spada & Moneta, 2012). Thus, students who are intrinsically motivated to study are likely to use creative cognition in order to achieve their educational goals and subject mastery, whereas students who are extrinsically motivated are likely to perceive their academic performance as ego involving, and experience high evaluation anxiety. Therefore, it was hypothesised that:

H 5.5   *Trait intrinsic motivation will positively correlate with (a) the deep approach to studying, whereas trait extrinsic motivation will positively correlate with (b) the surface approach to studying.*

H 5.7   *Trait intrinsic motivation will positively correlate with (a) the use of creative cognition, whereas trait extrinsic motivation will positively correlate with (b) evaluation anxiety.*

Metacognition was also found to be an important correlate of learning. Metacognition comprises psychological structures, beliefs and

control that support the interpretation and modification of thinking itself (Flavell, 1979). From a personality psychology perspective, metacognitive processes and beliefs are relatively stable and therefore, can be viewed as psychological structures.

Metacognition is broadly separated into maladaptive and adaptive (Beer & Moneta, 2010). On the one hand, maladaptive metacognition comprises of thoughts and beliefs that guide individuals' thinking, appraisal and coping, which result in maladaptive behaviour. People who have maladaptive metacognitive beliefs are at risk of developing psychological disturbances (Wells & Matthews, 1996). On the other hand, adaptive metacognitions refer to beliefs that facilitate successful problem solving in challenging situations (Beer & Moneta, 2010). As such, they facilitate adaptive behaviour and well-being.

In relation to studying, maladaptive metacognition (particularly first four factors) was found to have a direct effect on the surface approach to studying, and an indirect effect through evaluation anxiety on the surface approach to studying (Spada & Moneta, 2012; Spada et al., 2006). In the same manner, maladaptive metacognition is expected to undermine individual's learning and lead to the experience of negative affect in studying (Carver & Scheier, 1990, 2001).

The relationship between adaptive metacognition and adaptive learning strategies has not yet been investigated. However, it is expected that the ability to set functional and feasible study goals and the ability to

set mind for problem solving will assist in the development of strategic and deep approaches to studying. Furthermore, adaptive metacognition is expected to assist successful problem solving and therefore, facilitate progress in learning and associated with that positive affect in studying (Carver & Scheier, 1990, 2001). Indeed, the positive relationship was observed between all three factors of adaptive metacognition and positive affect in studying (Study 3).

The beneficial effect of adaptive metacognition was also found in effective and creative problem solving (Antonietti et al., 2000; Swanson, 1990, 1992). Therefore, adaptive metacognition is expected to provide some support to students who are willing to use creative cognition in studying. In Study 3 a positive relationship was found between the use of creative cognition in studying and all factors of adaptive metacognition. Therefore it was hypothesised that:

H 5.6   *Adaptive metacognition will positively correlate with (a) positive affect, (b) strategic and (c) deep approaches to studying, whereas maladaptive metacognition will positively correlate with (d) the surface approach to studying and (e) negative affect.*

H 5.7   *Adaptive metacognition will positively correlate with (c) the use of creative cognition in studying, whereas maladaptive*

metacognition will positively correlate with (d) evaluation anxiety.

The goal of this study is to empirically test the proposed chained mediation model of academic performance presented in Figure 6. The chained mediation model comprises of adaptive-positive and maladaptive-negative submodels (Figure 6). The adaptive-positive submodel includes psychological variables that are hypothesised to facilitate academic performance. The maladaptive-negative submodel in contrast includes psychological variables that are hypothesised to undermine academic performance.
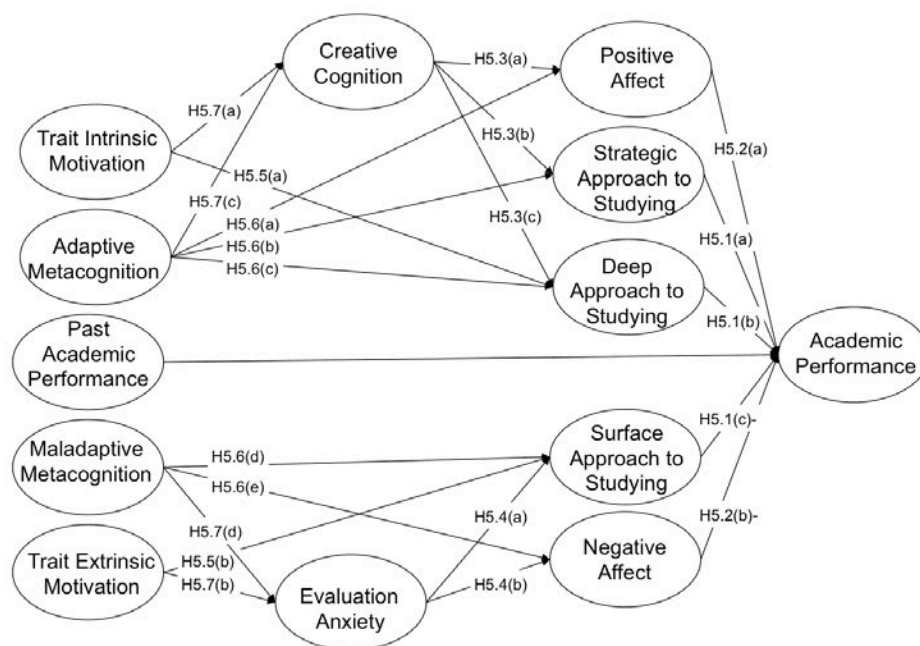
Figure 6: *The hypothesised chained mediation model of academic performance.*

As can be seen from the model, the adaptive-positive submodel firstly hypothesises that trait intrinsic motivation and adaptive metacognition will facilitate the use of creative cognition in studying (first-level mediator). Secondly, it hypothesises that the use of creative cognition in studying will lead to the experience of positive affect in studying, and to the development of adaptive approaches to studying (second-level mediators). And lastly, that positive affect in studying and adaptive approaches to studying, will promote higher academic performance.

The maladaptive-negative submodel firstly hypothesises that trait extrinsic motivation and maladaptive metacognition will explain the increase in evaluation anxiety (first-level mediator). Secondly, that evaluation anxiety will lead to the experience of negative affect in studying, and to the development of the maladaptive approach to studying (second-level mediators). And lastly, that negative affect in studying and the maladaptive approach to studying will undermine academic performance.

Taking into an account that prior academic performance is the strongest correlate of following academic performance (e.g., Busato, Prins, Elshout, & Hamaker, 2000; Salanova, Schaufeli, Martinez, & Breso, 2010; Zeegers, 2004), the two submodels will be tested firstly controlling for the effect of prior academic performance, and secondly, they will be tested simultaneously in the chained mediation model of

academic performance. This approach to testing the model will enable to identify the best candidate variables for prospective educational interventions.

5.2   Method

5.2.1   Participants

An opportunity sample of 500 students from a London university was invited to take part in this study. The response rate was 74.6%, resulting in a final sample of 373 students, who satisfied the inclusion criteria for this study. The inclusion criteria were (a) students had prior semester and current semester examination and coursework performance records, and (b) had fully completed the survey. Participants' demographic characteristics are summarised in Table 19.

The sample consisted of 93 (24.9%) male students with age range 18 to 54 ($M = 27.9$, $SD = 9.5$) and 280 (75.1%) female students with age range 18 to 50 ($M = 24.8$, $SD = 6.7$). The age and gender composition of this sample was similar to that of Studies 1, 2, 3 and 4. There were 174 (46.6%) British participants, 192 (51.5%) non-British participants, and 7 (1.9%) participants who did not report their nationality. Ethnically the sample comprised of 190 (50.9%) White, 68 (18.2%) Black, 31 (8.3%) Asian, 24 (6.4%) Mixed, 50 (13.4) students from other ethnic background, and 10 (2.7%) students refrained from reporting their ethnicity.

Table 19: *Summary of Participants' Demographic Characteristics (Study 5).*

Variable	N	%
Gender		
Male	93	24.9
Female	280	75.1
Faculty		
Life Science and Computing	203	54.4
Business School	109	29.2
Social Science and Humanities	36	9.6
Law and International Relations	23	6.2
Unknown	2	0.6
Degree level		
Foundation	11	2.9
1st year	111	29.8
2nd year	127	34
3rd year	79	21.2
Postgraduate	45	12.1
Ethnicity		
White	190	50.9
Black	68	18.2
Asian	31	8.4
Mixed	24	6.4
Other	50	13.4
Unknown	10	2.7
Nationality		
British	174	46.6
Non-British	192	51.5
Unknown	7	1.9

Students were from four main university faculties: 203 (54.4%) were from Faculty of Science and Computing, 109 (29.2%) from Business School, 36 (9.6%) from Faculty of Social Science and Humanities, 23 (6.2%) from faculty of Law and International Relations and 2 (0.6%) refrained from reporting their subject area; of who 11 (2.9%) were enrolled in foundation degree, 111 (29.8%) in the first year,

127 (34%) in the second year, 79 (21.2%) in the third year of their undergraduate degree, and 45 (12.1%) were enrolled in postgraduate courses.

5.2.2   Measures

Approaches and Study Skills Inventory for Students (ASSIST), Short 18-Item Form (Entwistle, 2008) is a self-reported questionnaire with six questions measuring each of the three domains of approaches to studying: deep (e.g., "When I'm working on a new topic, I try to see in my own mind how all the ideas fit together"), strategic (e.g., "I put a lot of effort into studying because I'm determined to do well"), and surface (e.g., "I concentrate on learning just those bits of information I have to know to pass"). The instructions used in this study were: "Please work through the following comments, giving your immediate response. In deciding your answers, think in terms of your current experience and behaviour when you engage in study activities, and choose one appropriate number according to the following scale". Responses were recorded on a 4-point scale ranging from 1 (*Disagree*) to 4 (*Agree*). The scores for each scale were calculated by averaging the scores of their constituent items. The internal consistency of the subscales in previous studies using similar student sample ranged from .67 to .76 (Moneta & Spada, 2009).

International Positive and Negative Affect Schedule - Short Form (I-PANAS-SF; Thompson, 2007) is a list of ten adjectives, five measuring positive affect (e.g., "Attentive") and five measuring negative affect (e.g., "Nervous"). The I-PANAS-SF was derived from the PANAS (Watson et al., 1988), and has retained only unambiguous items and items that can be clearly and uniformly understood by non-native English speakers (Thomson, 2007). The instructions used in this study were: "Please read the following adjectives in detail and think if you have those feelings. Please respond thinking of your current experience and behaviour when you engage in study activities". Adjectives were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The scores for each scale were calculated by averaging the scores of their constituent items. The I-PANAS-SF scores correlated strongly with the PANAS scores, and the subscales of positive and negative affect showed good 8-week test-retest reliabilities .84 (for both scales), and the good internal consistency of .74 for negative affect and .80 for positive affect (Thompson, 2007).

Use of Creative Cognition Scale (UCCS) in Studying (Study 2 and 3). This questionnaire was developed in Study 2 and validated in Study 3. The UCCS is a 5-item self-reported questionnaire measuring the tendency to deploy creative cognition to problem solving in studying (e.g., "I try to act out potential solutions to explore their effectiveness" and "I find effective solutions by combining multiple ideas"). The instructions for filling in the questionnaire were: "Following is a series of statements

about personal preferences and behaviours. Please indicate how frequently you engage in each behaviour during your study. Please respond thinking of your general studying experience and behaviour across situations and times". Responses were recorded on a 5-point scale ranging from 1 (*Never*) to 5 (*Always*). The UCCS has retained and modified 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 scores were calculated by averaging the scores of all five items. The test-retest reliability of the UCCS has not yet been estimated, whereas the internal consistency in the original validation study was .82. The scale has good concurrent validity through positive correlations with flow in studying, adaptive metacognitive traits, and trait intrinsic motivation (Study 2 & 3).

Evaluation Anxiety Scale (EVAN; Thompson & Dinnel, 2001) is a 15-item self-reported questionnaire measuring students' levels of evaluation anxiety (e.g., "I get anxious just prior to receiving the result of a test on which I was not certain of my performance"). The instructions used in this study were: "Please read each of the statement below carefully, assessing the extent to which each statement applies to your current experience and behaviour when you engage in study activities. By referring to the scale for each item, select the number that corresponds to your choice". Responses were recorded on a 7-point scale ranging from 1

(Not at all true of me) to 7 *(Very true of me)*. Scale scores were calculated by averaging its items. The internal consistency of the scale was .85 (Thompson & Dinnel, 2001).

Work Preference Inventory (WPI; Amabile et al., 1994) is a 30-item self-reported scale, of which 15 items measure trait extrinsic motivation and its subscales of compensation (e.g., "I am keenly aware of the goals I have for getting good grades") and outward (e.g., "I prefer having someone set clear goals for me in my work") and 15 measure trait intrinsic motivation and its subscales of challenge (e.g., "The more difficult the problem, the more I enjoy trying to solve it") and enjoyment (e.g., "I want my work to provide me with opportunities for increasing my knowledge and skills"). The instructions for filling in the questionnaire were: "Please rate each statement in terms of how true it is of you. Please respond thinking of your general experience and behaviour during your study". Thus, the questionnaire measured motivational orientations in the study context. 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 had satisfactory internal consistency of .70 for extrinsic motivation and .75 for intrinsic motivation, and had good concurrent validity through positive correlations with measures of

personal development, autonomy, ability utilisation and achievement (Loo, 2001).

Metacognitions Questionnaire 30 (MCQ-30; Wells & Cartwright-Hatton, 2004) is a 30-item questionnaire measuring the five maladaptive metacognitive traits: Positive Beliefs about Worry (e.g., "Worrying helps me to avoid problems in the future" and "I need to worry in order to remain organised"), Negative Beliefs about Thoughts Concerning Uncontrollability and Danger (e.g., "My worrying is dangerous for me" and "My worrying thoughts persist, no matter how I try to stop them"), Cognitive Confidence (e.g., "My memory can mislead me at times" and "I do not trust my memory"), Beliefs about the Need to Control Thoughts (e.g., "I should be in control of my thoughts all the time" and "If I did not control a worrying thought, and then it happened, it would be my fault"), and Cognitive Self-Consciousness (e.g., "I think a lot about my thoughts" and "I am aware of the way my mind works when I am thinking through a problem"). The instructions for filling in the questionnaire were: "This questionnaire is concerned with beliefs people have about their thinking. Listed below are a number of beliefs people have expressed. Please read each item and indicate how much you generally agree with it. Please respond thinking of your general experience and behaviour across situations and times". Thus, this questionnaire measured maladaptive metacognitions as uncontextualised traits. 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 had good internal consistency in the range of .72 to .93, and good convergent validity through positive correlations with obsessive-compulsive symptoms, worry, and trait anxiety (Wells & Cartwright-Hatton, 2004).

Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ; Beer & Moneta, 2010) is an 18-items self-reported scale measuring the three adaptive metacognitive traits: Confidence in Extinguishing Perseverative Thoughts and Emotions (e.g., "In times of "feeling in the dumps" it's hard for me to regulate my low mood") - reversed, Confidence in Interpreting Own Emotions as Cues Restraining from Immediate Reaction, and Mind Setting for Problem Solving (e.g., "I can stop any "negative thinking spirals" and focus on what I can do in the situation"), and Confidence in Setting Flexible and Feasible Hierarchies of Goals (e.g., "I can prioritise my needs and formulate a hierarchy of goals"). The instructions for filling in the questionnaire were: "This questionnaire is concerned with beliefs people have about their thinking and emotions in difficult situations. Listed below are a number of such beliefs that people have expressed. Please read each item and indicate how much you generally agree with it. Please respond thinking of your general experience and behaviour across situations and times". Thus, the questionnaire measured adaptive metacognitions as uncontextualised traits. 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 had good internal consistency in the .80 to .88 range, and good convergent validity through a negative correlation of PMCEQ-1 with maladaptive metacognition and positive correlations of PMCEQ-2 and PMCEQ-3 with trait intrinsic motivation (Beer & Moneta, 2010).

Students' Academic Performance was recorded from the university database. Students' grades expressed in percentage points (with 40% representing the minimum passing grade) were retrieved from the university database for the current and previous semesters. Individual examination grades and individual coursework grades were separately identified for each participant and student's semester average was calculated separately for each of the two types of assessments across all the modules taken in that semester.

5.2.3 Procedure

Ethics approval for this study was obtained from a university ethics board. The data collection was done electronically using SurveyMonkey tool. The invitation letter, information sheet with explanations of the purpose and procedure for the study, and the hyperlink to the electronic copy of the questionnaire were sent to students' university e-mail addresses. The access to the survey was conditional to providing informed consent.

Participants' academic performance[7] records were retrieved from the university database and linked with their responses on the self-reported questionnaires. All participants provided informed consent and authorised the researcher to link their questionnaire data with their academic performance records. Following the synchronisation process the data for each participant was anonymised and pulled together with the data from other participants prior to data analysis. The raw performance data and questionnaire responses were stored in accordance with the Data Protection Act (1998) and were not used in any data analysis.

5.2.4 Data analysis

The hypothesised chained mediation model was tested using structural equation modelling executed in LISREL 8.8 (Jöreskog & Sörbom, 1996). All variables in the model were defined as latent variables in order to control for measurement error. Prior academic performance and current semester academic performance were defined as

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[7] The prior academic performance of first year undergraduate degree students' was calculated on either grades that they obtained in their foundation degree (if they took part in this study during the first semester of their undergraduate degree) or 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 their undergraduate degree). Foundation degree students' were all in the second semester of their foundation degree, and hence the grades from the first semester of their foundation degree were used as a measure of their prior academic performance.

two single latent variables with average examination grade and average coursework grade (corresponding with each semester) used as indicators.

Positive affect, negative affect and creative cognition were included as latent variables and five constituent items from each questionnaire were used as congeneric indicators of their latent variables. Two factors (factor 2 and 3) of PMCEQ scale were used as indicators of a single latent variable of adaptive metacognition and four factors of the MCQ scale (factor 1, 2, 3 and 4) were used as indicators of a single latent variable of maladaptive metacognition.

Indicators for all other variables in the model (i.e., trait intrinsic motivation, trait extrinsic motivation, evaluation anxiety, deep, strategic and surface approaches to studying) were created using parcelling, which is a technique of creating aggregate-level indicators that gives the lowest level of data to be modelled. The parcels were created as follows. Firstly, a single-factor principal axis factoring model was fitted to the items of each scale separately in order to check whether a single factor was sufficient and the scale was unidimentional. Secondly, the factor loading coefficients were checked to be positive and in cases where coefficients were negative, the corresponding items were excluded from the parcels. Finally, using the "item-to-construct" method (Little, Cunningham, Shahar, & Widaman, 2002) three parcels were created for each of the latent constructs. The examination of the factor loading coefficients revealed that all factor loading coefficients were positive for the

exception of two items in the trait extrinsic motivation scale that had negative factor loading coefficients and therefore, were excluded from the parcels. All the constituent parcels loaded well on their intended latent factors.

The chi-square test (Jöreskog & Sörbom, 1996) was used to examine the fit of the model to the data. The fit of the model was evaluated using the following indices with Hu and Bentler's (1999) cutoff values for close fit: the Comparative Fit Index (CFI) and the Non-Normed Fit Index (NNFI) with the cutoff point of .95, the Standardized Root Mean Square Residual (SRMR) with the cutoff point of .05, and the Root Mean Square Error of Approximation (RMSEA) with the cutoff point of .05.

The chained mediation was also tested for each significant correlate of academic performance in SPSS employing Hayes (n.d.) *PROCESS* macro (model 6). Study variables for this analysis were calculated by averaging the scores of each variable's constituent items. Hayes (n.d.) *PROCESS* macro (model 6) provides bootstrap estimates with bias-corrected confidence intervals of the indirect effects. An indirect effect is significant if zero is outside of the confidence intervals for that indirect effect. The indirect effect for each significant independent variable on academic performance was tested separately controlling for covariates i.e., other independent variables and prior

academic performance. This allowed to partial out covariates from the dependent variable and mediators.

5.3   Results

5.3.1   Descriptive statistics

The means, standard deviations, bivariate correlations and reliability coefficients for study variables were calculated prior to the model testing and are presented in Table 20. All study variables had good reliability (Cronbach's alpha above .70) for the exception of trait extrinsic motivation, which just failed to reach satisfactory standard.

As expected, present semester examination and coursework grades strongly intercorrelated and correlated with the prior semester examination and coursework results. Positive affect in studying moderately and positively correlated with both measures of academic performance, whereas negative affect moderately and negatively correlated with both measures of academic performance. These results are consistent with hypotheses 5.2 (a, b). Furthermore, positive affect strongly and positively correlated with the tendency to use creative cognition and both measures of adaptive metacognition, which is in line with hypotheses 5.3 (a) and 5.6 (a). Negative affect as expected showed moderate to strong positive correlation with evaluation anxiety and all four factors of maladaptive metacognition, which is in line with hypotheses 5.4 (b) and 5.6 (e).

Table 20: *Means, Standard Deviations, Cronbach's alpha (in parentheses) and Correlation Coefficients of the Study Variables (Study 5).*

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	15.3	(-)																		
2. Cw	61.6	11.1	.62**	(-)																	
3. Prior Ex	59.2	15.1	.64**	.52**	(-)																
4. Prior Cw	62.1	11.2	.59**	.55**	.6**	(-)															
5. Deep	3	.5	.04	.05	.03	.04	(.76)														
6. Strategic	2.9	.6	.23**	.19**	.23**	.24**	.51**	(.81)													
7. Surface	2.3	.6	-.24**	-.23**	-.21**	-.19**	-.15**	-.38**	(.72)												
8. PA	3.6	.8	.14**	.18**	.08	.12**	.44**	.61**	-.37**	(.8)											
9. NA	2.1	.8	-.16**	-.14**	-.11*	-.11*	-.09*	-.22**	.45**	-.1*	(.8)										
10. EVAN	4	1	-.13**	-.11*	-.15**	-.06	-.21**	-.25**	.52**	-.2**	.46**	(.83)									
11. UCCS	3.7	.7	.12*	.22**	.1*	.14**	.55**	.47**	-.21**	.48**	-.11*	-.23**	(.83)								
12. IM	2.9	.5	.1*	.16**	.1*	.13**	.49**	.38**	-.3**	.45**	-.15**	-.29**	.57**	(.81)							
13. EM	2.7	.4	.09*	.18**	.1*	.16**	.13**	.14**	.08	.17**	.14**	.29**	.16**	.11*	(.68)						
14. AM 2	2.5	.6	.06	.12**	.1*	.08	.28**	.35**	-.35**	.33**	-.28**	-.41**	.42**	.42**	-.09	(.79)					
15. AM 3	2.7	.7	.17**	.19**	.2**	.16**	.27**	.45**	-.39**	.43**	-.29**	-.34**	.47**	.43**	.04	.71**	(.85)				
16. MM 1	2	.8	.03	.05	-.01	.02	.07	.01	.15**	.07	.2**	.14**	.08	.08	.2**	.05	.11*	(.89)			
17. MM 2	2.1	.8	-.07	-.06	.05	-.06	-.01	-.15**	.37**	-.13**	.5**	.37**	-.06	-.11	.16**	-.28**	-.27**	.31**	(.85)		
18. MM 3	1.9	.7	-.09*	-.06	-.06	-.04	-.1*	-.27**	.38**	-.22**	.31**	.35**	-.09*	-.14**	.08	-.22**	-.23**	.22**	.5**	(.83)	
19. MM 4	2	.7	-.13**	-.06	-.17**	-.08	.05	-.06	.15**	-.05	.23**	.14**	.09*	.07	.23**	.07	.01	.31**	.44**	.39**	(.73)

Notes. $n = 373$; "-" means that the corresponding statistic cannot be estimated; *$p < .05$ (1-tailed), ** $p < .01$ (1-tailed). Ex – examination; Cw – coursework; PA – positive affect; NA – negative affect; EVAN – evaluation anxiety; UCCS – use of creative cognition; IM – intrinsic motivation; EM – extrinsic motivation; AM – adaptive metacognition; MM – maladaptive metacognition.

The strategic approach to studying but not the deep approach to studying showed a moderate positive correlation with both measures of academic performance, whereas the surface approach to studying showed a moderate negative relationship with both measures of academic performance. These results are consistent with hypotheses 5.1 (a, c). Additionally, the strategic approach to studying showed strong and positive correlation with the frequency of use of creative cognition and both factors of adaptive metacognition, which is consistent with hypotheses 5.3 (b) and 5.6 (b). The deep approach to studying showed strong positive correlation with the use of creative cognition and trait intrinsic motivation, which is consistent with hypotheses 5.3 (c) and 5.5 (a). The surface approach to studying showed a strong positive relationship with evaluation anxiety and strong to moderate positive correlations with all four factors of maladaptive metacognition, which is consistent with hypotheses 5.4 (a) and 5.6 (d).

The tendency to use creative cognition strongly and positively correlated with trait intrinsic motivation and both factors of adaptive metacognition, which is in line with hypotheses 5.7 (a, c). Evaluation anxiety, as expected, strongly and positively correlated with trait extrinsic motivation and all four factors of maladaptive metacognition, which is in line with hypotheses 5.7 (b, d).

5.3.2   Structural equation modelling

The chi-square test for the hypothesised model was significant (χ^2= 1624.86, df = 827, p < .001), indicating that the model does not fit strictly. The other fit indices showed that the model has a satisfactory fit (CFI = .96, RMSEA= .051, NNFI = .95, SRMR = .085). The overall 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 the surface approaches to studying, 53% in the use of creative cognition in studying and 34% in evaluation anxiety.

Figure 7 demonstrates the final model with estimated standardised path coefficients. The only significant correlates of academic performance were prior academic performance and positive affect, which supports hypothesis 5.2 (a). In comparison to the hypothesised model, the estimated model did not retain paths from approaches to studying to academic performance and from negative affect to academic performance, thus hypotheses 5.1 (a, b, c) and 5.2 (b) are not supported.

The paths from the use of creative cognition to positive affect, deep and strategic approaches to studying were all significant. The paths from evaluation anxiety to negative affect and the surface approach to studying were also significant. Thus, hypotheses 5.4 (a, b) are fully supported.
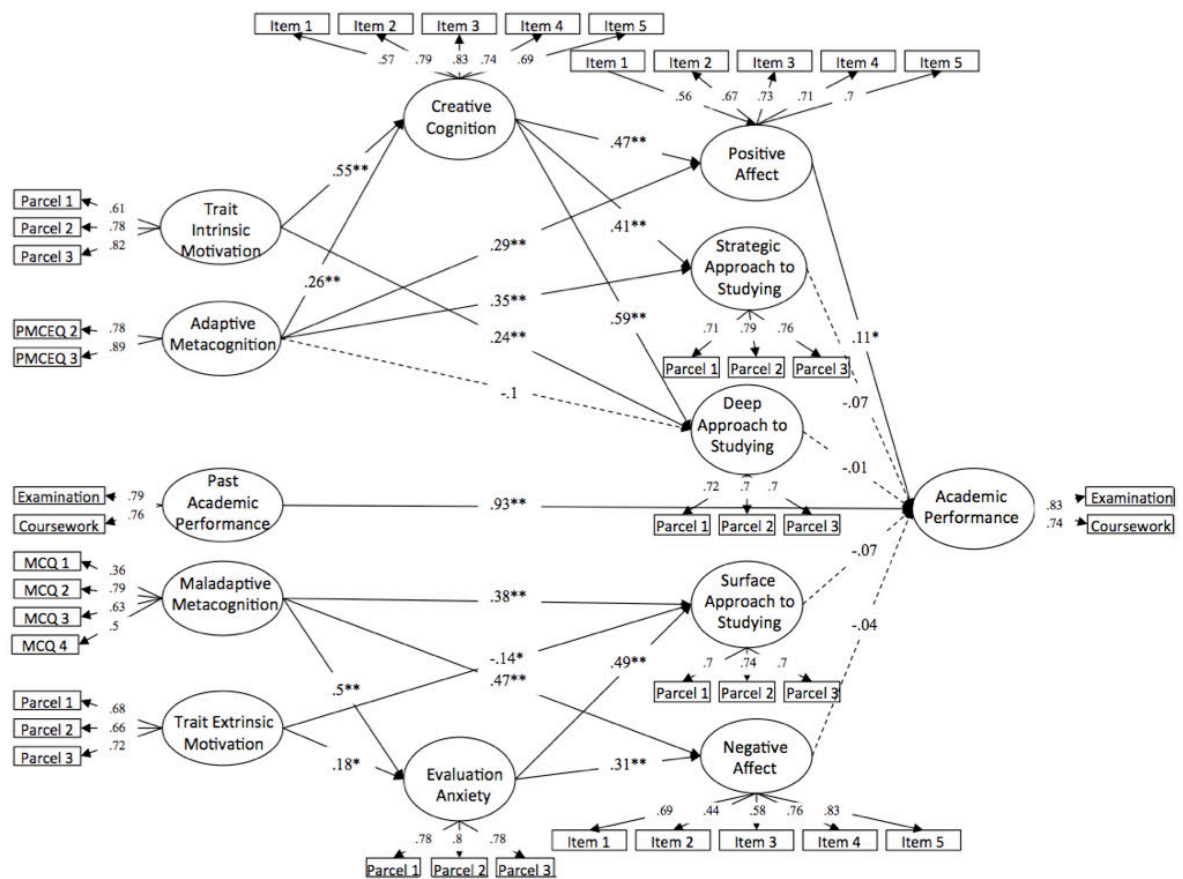
Figure 7: *The estimated chained mediation model of academic performance with prior academic performance and positive affect in studying being the only significant correlates of current semester academic performance.*

The paths from adaptive metacognition to positive affect, the strategic approach to studying and the use of creative cognition were also all significant at least at the $p < .05$ level, which supports hypotheses 5.6 (a, b) and 5.7 (c). However the path from adaptive metacognition to the deep approach to studying was not significant. As such, hypothesis 5.6 (c) is not supported.

The paths from maladaptive metacognition to negative affect, the surface approach to studying and evaluation anxiety were also all significant at least at the p < .05 level. Thus, hypotheses 5.6 (d, e) and 5.7 (d) are fully supported. The paths from trait intrinsic motivation to the deep approach to studying and the use of creative cognition; and from trait extrinsic motivation to evaluation anxiety and the surface approach to studying were all significant. As such, hypotheses 5.5 (a, b) and 5.7 (a, b) are supported.

Two alternative models were tested to examine whether the hypothesised model had a better fit to the data. The comparison was based on the chi-square difference test (Jöreskog & Sörbom, 1996). The *alternative model 1* had the same paths as the hypothesised model, but in addition included a structural path from trait intrinsic motivation to positive affect. According to the self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000), self-determination provides individuals with a sense of personal causation, agency, and control. It is empowering, and typically results in heightened intrinsic motivation, which is accompanied by the emotions of enjoyment of, and interest in the activity. Therefore, the direct path from trait intrinsic motivation to positive affect in studying was tested in the alternative model 1. The results of SEM revealed that the direct path from trait intrinsic motivation to positive affect was non-significant. In addition, the hypothesised model showed to be superior to the alternative model 1 (Delta $\chi^2(1) = 1$, p = .317).

The *alternative model 2* had the same paths as the hypothesised model and a direct path from the use of creative cognition to academic performance. However, the alternative model 2 did not converge, which leaves the hypothesised model to be a better fit for the data by default, as non-convergence is a typical sign of over-parameterization.

5.3.3   Test of mediation

The only significant psychological correlate of academic performance was positive affect in studying. Therefore, the standardised indirect effects of trait intrinsic motivation and adaptive metacognition on academic performance through two sequential mediators i.e., the use of creative cognition in studying (first-level mediator) and positive affect in studying (second-level mediator), were further tested using Hayes (n.d.) *PROCESS* macro (model 6). The model was tested separately for each independent variable using prior academic performance and second independent variable as covariates in the model.

Adaptive metacognition (Effect = .121, CI = .004; .323) and trait intrinsic motivation (Effect = .266, CI = .013; .687) had indirect effects through the use of creative cognition in studying (first-level mediator) and positive affect in studying (second-level mediator) on academic performance. Thus, the results provide further support for hypotheses 5.7 (a, c), 5.3 (a) and 5.2 (a).

5.4   Discussion

The aim of this study was to test the comprehensive, chained mediation model of academic performance, where trait motivation and metacognition were independent variables, the use of creative cognition and evaluation anxiety were first-level mediator variables, affect in studying and approaches to studying were second-level mediator variables, and academic performance was the outcome variable. The model was tested statistically controlling for the effect of prior semester academic performance.

5.4.1   *Facilitators of academic performance*

Structural equation modelling showed that adaptive metacognition and trait intrinsic motivation facilitated the frequency of use of creative cognition in studying. These findings are in line with Antonietti, Ignazi and Perego (2000) and Swanson (1990, 1992) research findings, which identified metacognition as an important contributor in creative problem solving. The results are also in line with Amabile's et al. (1986) and Hennessey's et al. (1989) research findings, which emphasised the importance of intrinsic motivation in facilitating creative outputs. Adaptive metacognition and trait intrinsic motivation conjointly explained 53% of variance in the use of creative cognition in studying with trait intrinsic motivation being a stronger correlate.

Adaptive metacognition also facilitated the development of the strategic approach to studying, but not the deep approach. Biggs, Kember and Leung (2001) argued that deep and surface approaches to studying conceptually describe the way students engage with learning material, whereas the strategic approach to studying conceptually describes students' organisation of their study time and resources. As such, students who are able to extinguish perseverative thoughts and emotions, can set their mind for problem solving and desire a more structured and organised study environment, are likely to adopt the strategic approach to learning rather than the deep approach.

Trait intrinsic motivation in contrast to adaptive metacognition had a direct effect on the deep approach to studying, but not the strategic approach. These findings further corroborate the previous research results (Moneta & Spada, 2009; Spada & Moneta, 2012). Thus, students who are interested in the topic they study are likely to satisfy their curiosity through mastery of study material, which can be largely achieved through deep learning.

Furthermore, trait intrinsic motivation and adaptive metacognition had indirect effect on deep and strategic approaches to studying through the use of creative cognition in studying. Thus, students who are intrinsically motivated to learn, are able to adapt to challenging study situations and set feasible goals, are likely to engage in creative thinking. Such students are open to experiment with ideas and generate new ideas

and unusual relationships between ideas by using divergent and convergent thinking, metaphorical and analogical thinking, perspective taking and visualisation, which conjointly facilitate adoption of adaptive approaches to studying.

Adaptive metacognition also had a direct effect on positive affect in studying and an indirect effect through the use of creative cognition in studying, whereas trait intrinsic motivation only had an indirect effect on positive affect through the use of creative cognition in studying. These results are in line with the findings from correlational research where both adaptive metacognition and intrinsic motivation positively correlated with the frequency of use of creative cognition in studying and with positive affect in studying (Study 3).

These results are supported by control-process theory (Carver & Scheier, 1990, 2001), which would predict that adaptive behaviour leads to faster progress, which facilitates positive affect. Thus, the use of creative cognition in studying facilitates faster/better progress in studying, which manifest through experience of positive affect in studying.

The strongest correlate of academic performance was prior semester academic performance. This study was the first one to control for the measurement error in both prior semester and current semester academic performance. Controlling for the measurement error is a methodological advantage as it controls for the difference between the various types of assessments and variability due to chance. As a result,

the prior academic performance became a very strong correlate of following academic performance and the standardised coefficient for this relationship was much higher than the one observed in Study 1.

Out of all psychological variables tested in the comprehensive, chained mediation model, only positive affect in studying correlated with students' academic performance. This further reinforces conclusions of the first study. Moreover, trait intrinsic motivation and adaptive metacognition had an indirect effect on learning and academic performance through two sequential mediators (i.e., the tendency to use creative cognition and positive affect in studying). As such, students who are intrinsically motivated and have feasible study goals are likely to use creative cognitive strategies in studying and as a result progress faster towards their learning goals. Faster progress leads to the experience of positive affect (Carver & Scheier, 1990, 2001), which enhances cognitive, social and psychological resources available to students (Fredrickson, 1998, 2001), which in their turn enable better learning and consequently higher academic performance. Furthermore, students who interpret their positive affect in studying as a sign of liking the activity are more likely to spending more time studying (Martin et al., 1993) and ultimately more likely to achieve higher academic performance. However, even though the effect of positive affect on academic performance was significant, it was small, leaving prior semester academic performance to be the strongest correlate of following semester academic performance.

5.4.2 *Inhibitors of academic performance*

Structural equation modelling showed that maladaptive metacognition explained evaluation anxiety, which is in line with Wells' and Matthews' (1996) prediction that individuals who have maladaptive thoughts and beliefs are likely to develop psychological disturbances and, in the case of students, experience evaluation anxiety. Structural equation modelling also showed that trait extrinsic motivation explained evaluation anxiety, which is in line with Amabile's et al. (1994) prediction that extrinsically motivated students are likely to use academic performance as a judgement of self-worth, which leads to the experience of higher levels of evaluation anxiety.

Furthermore, maladaptive metacognition had both direct and indirect effects (trough evaluation anxiety) on the adoption of the surface approach to studying. These results are consistent with the previous research findings where maladaptive metacognition had an indirect effect on the surface approach to studying through evaluation anxiety (Spada & Moneta, 2012), and where evaluation anxiety had a direct effect on the surface approach to studying (Cermakova et al., 2010; Moneta et al., 2007).

Unexpectedly, trait extrinsic motivation had a preventative direct effect on surface learning, indicating that trait extrinsic motivation is not all maladaptive. However the direct preventative effect of trait extrinsic

motivation on the maladaptive learning strategy was much smaller than an indirect undermining effect through evaluation anxiety. As such, a student who is extrinsically motivated and is guided by fear of failure is likely to experience evaluation anxiety, which leads to surface learning. However, if a student is extrinsically motivated and perceives assessments as an opportunity to "show off", s/he is less likely to experience evaluation anxiety and will refrain from surface learning.

Maladaptive metacognition also had a strong direct effect on negative affect and indirect effect through evaluation anxiety. Thus, students who have maladaptive metacognitive beliefs are likely to perceive the study environment (in particular assessments) as a threat and therefore, are likely to focus on the danger of failing assessments as a way of preventing undesired outcome. This ultimately leads to a deficiency of cognitive resources and a slow progress in studying that manifests through the experience of negative affect in studying.

Trait extrinsic motivation had indirect effect on negative affect in studying through evaluation anxiety. This suggests that students who are extrinsically motivated but not anxious have enough cognitive resources for effective learning and desired progress and therefore, do not experience negative affect. However, none of the variables hypothesised to undermine learning and academic performance explained poorer learning progress and lower academic performance. Conclusively, this study demonstrated that adaptive-positive structures and processes are

superior to maladaptive-negative structures and processes in explaining learning and academic performance.

These research findings should be viewed in the light of three key methodological limitations. Firstly, as in all previous studies, this study gathered data from a heterogeneous students sample from various faculties, ethnic backgrounds, and nationalities, which is an appropriate choice of a sample for an initial testing of the model. Secondly, this study is cross-sectional and, therefore, cannot imply causation. Finally, this model did not take into an account the reciprocal relationships between the variables (e.g., positive affect and the use of creative cognition). In this study, the alternative model 1 (where the trait intrinsic motivation had a direct link to positive affect in studying) showed to be inferior to the hypothesised model, and the alternative model 2 (where the use of creative cognition was placed as an equal with positive and negative affect in studying and approaches to studying, and had a direct path to academic performance) did not converge, which leaves the hypothesised model to be a better fit for the data. However, the comprehensive, chained mediation model still needs further refinement.

Despite this study's limitations, the current Ph.D. research adds a unique contribution to the established knowledge base. The proposed chained mediation model of academic performance overall explained 90% of variance in academic performance with prior academic performance and positive affect in studying being the only significant

correlates. The reasonably good fit of the model to the data as well as the results of previous four studies suggest that the proposed chained mediation model is a viable framework for designing educational interventions aiming to improve students' learning and academic performance.

CHAPTER 6 - GENERAL DISCUSSION

6.1   Overview

Educational literature univocally suggests that prior academic performance is the best correlate of future academic performance (e.g., Diseth, 2007; Duff, 2004; Zeegers, 2004). As such, research aiming to identify the psychological correlates of learning should test their effect on learning and academic performance controlling for the effect of prior academic performance. This rigorous testing of the effects psychological variables have on learning, enables identifying the best "candidate" variables for intervention. This Ph.D. research tested the effects of six psychological correlates of academic performance: 1) approaches to studying, 2) positive and negative affect in studying, 3) the use of creative cognition, 4) evaluation anxiety, 5) metacognition and 6) motivation, in the comprehensive, chained mediation model of academic performance.

6.2   Summary of Main Findings

The review of the approaches to studying theory, four theories of emotions and research examining the relationship between approaches to studying, emotions in studying and academic performance set the framework for Study 1. In Study 1 the effects of approaches to studying

and positive and negative affect in studying on students' academic performance were tested controlling for the effects of prior academic performance and evaluation anxiety. The effects of approaches to studying and positive and negative affect in studying were estimated separately for the three different types of assessments i.e., examination performance, coursework performance and overall GPA performance. Furthermore, this study was the first one to use compatible/identical measures of prior semester and current semester academic performance (e.g., prior semester examination performance and current semester examination performance).

In accordance with the approaches to studying theory it was hypothesised that deep and strategic approaches to studying will positively correlate, whereas the surface approach to studying will negatively correlate with students' academic performance. The correlation analysis indeed supported the hypothesised relationships with the exception of the deep approach. The deep approach failed to correlate with any measure of academic performance. However, the results of the hierarchical regression modelling identified that the relationship between approaches to studying and academic performance vanished when controlling for the effect of prior academic performance, evaluation anxiety and positive and negative affect in studying.

Similar results were also obtained in Study 5. The correlation analysis showed similar correlation coefficients for the relationship

between approaches to studying and academic performance as in Study 1. Thus, there was a positive relationship between the strategic approach to studying and academic performance, and a negative relationship between the surface approach to studying and academic performance. However, the structural equation modelling results indicated that approaches to studying were non-significant correlates of academic performance when controlling for prior academic performance.

With regards to positive and negative affect in studying it was hypothesised that positive affect will positively correlate, whereas negative affect will negatively correlate with students' academic performance. As expected, the results of the correlation analysis supported the hypothesised relationships. The hierarchical regression modelling identified negative affect to be a significant correlate of poorer examination and GPA grades, but only when measured in the second half of a semester.

Study 1 was also the first one to control for a confounder of negative affect i.e., evaluation anxiety (Arkin et al., 1982; Stowell et al., 2008). Results showed that negative affect explained out the effect of evaluation anxiety for both examination and GPA performance. Conclusively, negative affect in studying was independent of evaluation anxiety and was a stronger correlate of students' learning progress.

The main finding of Study 1 was that positive affect was an overall better correlate of all measures of academic performance than

negative affect and approaches to studying. However, the moderate correlation between positive affect and prior academic performance suggests that prior academic performance could have an indirect effect on following academic performance through positive affect in studying. The mediation analysis revealed that the reinforcement process such as good prior academic performance fosters positive affect, which in turn fosters good following academic performance, was weak. Conclusively, the relatively small indirect effect eliminated the possibility that positive emotions in studying were solely due to liking studying or high prior academic performance.

Overall, Study 1 strongly indicated that positive and negative affect in studying was superior to approaches to studying in explaining academic performance. A possible explanation for the failure of the strategic approach to studying to explain academic performance is that positive affect in studying is partially overlapping and a stronger correlate of academic performance. By the same token, an explanation for the failure of the surface approach to studying to explain academic performance is that negative affect in studying is partially overlapping and a stronger correlate of academic performance. As such, asking students "how do you feel when you are studying?" seems to provide more insight into learning progress, or lack thereof, than asking students "how do you study?"

Furthermore, the facilitative effect of positive affect on academic performance was also corroborated in Study 5. Positive affect was the only psychological variable to explain academic performance in the chained mediation model of academic performance. Importantly, the relationship between positive affect and academic performance remained significant even when controlling for the measurement error in prior and current academic performance. However, the effect of positive affect on academic performance was small, but nonetheless significant. The small effect size can be partially due to statistically controlling for the measurement error in prior and current academic performance, which resulted in a much stronger relationship between the two measures of academic performance.

Conclusively, Study 1 and Study 5 on the one hand found that approaches to studying were poor correlates of academic performance. On the other hand, the findings strongly indicated that positive affect in studying and, to some extent, negative affect in studying were overall better correlates of academic performance.

Creativity was identified as one of the strongest correlates of positive affect. The review of the creative cognition framework and the research examining the relationship between creative thinking strategies and academic performance led to the conclusion that in education context, it is not creative ability per se that is important for learning, but rather a tendency to use creative thinking strategies in studying. Therefore, in

contrast to other creativity research that looked at individuals' ability for creativity, current Ph.D. research examined the effect of context dependent deployment of creative cognition in studying on students' academic performance.

The review of the existing creativity scales identified the lack of adequate instruments for measuring the frequency of applying creative thinking strategies in an endeavour in achievement situations. Therefore, the first step was to develop a self-reported scale capturing the creativity construct in question i.e., students' frequency of use of creative cognition in studying.

In Study 2 and 3 the new UCCS questionnaire was developed and validated. UCCS was derived from CPAC scale. The confirmatory factor analysis showed that the new scale was a unidimentional measure, and reliability and correlation analysis showed that UCCS displayed good consistency, concurrent and discriminant validity.

The new UCCS scale was used to examine the relationship between the use of creative cognition in studying and positive affect in studying. Overall literature review identified that positive affect explained higher creativity. This link was observed in both experimental studies (e.g., Hirt, Levine, McDonald, Melton, & Martin, 1997; Isen, 1998; Vosburg, 1998) and field research (Amabile et al., 2005). However, there was almost no support found for the longitudinal relationship from

creativity to positive affect, with the exception of Amabile's et al. (2005) field research.

The results of the two-wave longitudinal study (Study 4) provided strong support for the reciprocal longitudinal relationship between positive affect in studying and the use of creative cognition in studying. Hence, students who used creative cognition in studying displayed elevated levels of positive affect in studying, which facilitated their use of creative cognition in learning. Understanding this relationship between deployment of one's creative ability to an endeavour and positive affect was the first step towards understanding how positive affect in studying can be enhanced/stimulated.

Study 5 further corroborated that the use of creative cognition in studying was a strong correlate of positive affect in studying. The results of the structural equation modelling and mediation analyses firstly showed that trait intrinsic motivation and adaptive metacognition had an indirect effect on positive affect through the frequency of use of creative cognition; and secondly, that the use of creative cognition had an indirect effect on students' academic performance through positive affect in studying.

The direct link from the use of creative cognition to academic performance was tested in the alternative model of academic performance. However, the alternative model did not converge and as

such, it is still unclear if the tendency to use creative cognition can explain academic performance directly.

Importantly, the final chained mediation model developed and tested in Study 5 allowed to simultaneously examine effects of adaptive-positive structures (trait intrinsic motivation and adaptive metacognition) and processes (the use of creative cognition, positive affect and strategic and deep approaches to studying) and maladaptive-negative structures (trait extrinsic motivation and maladaptive metacognition) and processes (evaluation anxiety, negative affect and the surface approach to studying) on students' academic performance. Overall, only adaptive-positive structures and processes accounted for a significant portion of variance in academic performance when statistically controlling for the effect of prior academic performance.

The examination of the correlational patterns between variables from two competing submodels (adaptive-positive and maladaptive-negative) revealed that the two submodels were independent of each other. This implies that adaptive-positive structures and processes are not inverse of maladaptive-negative structures and processes. Therefore, the absence of maladaptive-negative structures and processes does not by default indicate the presence of adaptive-positive structures and processes, and vice versa. Even though, the momentary measure of adaptive-positive and maladaptive-negative structures and processes is

likely to result in negative correlation, when they are measured as overall behavioural tendencies, they become orthogonal.

This counterintuitive relationship between adaptive-positive and maladaptive-negative submodels is well portrayed by the circumplex model of emotions (Russell & Carroll, 1999). The circumplex model of emotions posits that feeling positive emotions does not by default mean the absence of negative emotions, and vice versa.

The orthogonal nature of adaptive-positive and maladaptive-negative submodels implies that, for instance, reducing levels of evaluation anxiety will not lead to the development of creative cognition. In the same manner, preventing adoption of the surface approach to studying will not make students strategic or deep learners. Therefore, when designing interventions/programmes aiming to improve students' learning and academic performance, it is more important to concentrate on variables that facilitate learning, namely positive affect and the use of creative cognition.

6.3   Limitations

Current Ph.D. research has a number of key limitations that should be considered when evaluating the findings. The first key limitation common to all five studies is the student samples. All participants were volunteers from the same London University. Furthermore, the participants in all five studies were predominantly females, which limits

the applicability of the findings to universities or courses with a large male population. Nevertheless, the sample in each study was heterogeneous in terms of age, ethnicity, nationality, programmes of study and degree levels. Such a diverse sample is acceptable for initial testing of the hypotheses and it also enables these research findings to be generalised beyond the participating university. However, future research should aim to test the observed relationships between psychological correlates of learning and academic performance in more homogeneous samples (e.g., subject, faculty, year of education) as well as using samples from several universities.

The student samples in each study were very similar in terms of gender and age distribution and as such, can be considered representative of the overall university's student population. The university statistics showed that the majority of students at the university were UK nationals (80%). The international students (20%) were predominantly from Europe e.g., Germany, France, Poland and Italy, followed by a smaller portion of students from non-EU countries e.g., Nigeria, China, Pakistan and India. In all studies, samples were almost equal in the numbers of home and international students, which indicates that international students were well presented in the student sample.

To better understand students' learning experience at the participating university, it is important to understand their educational environment. The participating university's statistics showed that the

majority of enrolled students (97%) were from state schools. The university's average enrolment requirement was normally three passes in GCSEs or equivalent at Grade C or above. Evidently, the enrolment criteria was rather low, suggesting that students who got into the university may display a greater degree of struggle in studying and poorer academic performance due to their poor prior academic achievements.

Consequently, the successful completion of the degree over a period of three years (when data collection took place) ranged from 66.1% to 72.1%, and the university scored on average in the bottom 10 universities in the UK League Table Ranking. As such, the participating university had the optimal settings for building an empirical foundation for an educational intervention aiming to improve students' learning and academic performance. The chained mediation model forming a framework for the prospective intervention was tested in a student sample for whom intervention would be beneficial and should be designed for.

The second main limitation is the use of students' academic performance as a measure of learning progress. This limitation applies to Study 1 and 5. Perhaps the main criticism for using academic performance as a measure of learning, is its' objectivity and reliability. The objectivity and reliability of academic performance is determined by the marking practice within an institution. The marking process within the participating university was heavily regulated and controlled. This suggests that the measures of academic performance in Study 1 and Study

5 were fairly accurate reflections of students' learning progress as defined by the University.

The marking process within the participating university included the following three steps. Firstly, at least 20% of all coursework assessments and examinations as well as all works above 70% (first class) and bellow 40% (pass) were double marked. The double marking process ensured the consistency in marking across all tutors. Secondly, following the double marking process, all works were moderated. Moderation ensured quality in marking, and was done by a third party who usually was not teaching on that course or was not involved in assessments. Thirdly, following moderation, external examiners from other universities reviewed 20% of randomly selected works. External examiners ensured that the quality of work indeed corresponded with the Higher Education standards ("Academic Regulations," 2012).

In both Study 1 and Study 5 no measure of effort in studying – such as attendance and time devoted to studying – was gathered. Hence, these studies could not discern whether positive and negative affect in studying were only indicators of learning progress or were also causal factors for it.

Despite the objectivity and reliability of academic performance, there are other measures of learning progress that should be considered in future research. For example, each student's evaluation of one's own performance may be more important than objective performance per se.

For example, a C grade for one student can be a catastrophe, whereas for another student it is a joy.

According to the *social cognitive theory of self-regulation* (Bandura, 1991) performance standards play a key role in one's self-regulated behaviour. Personal standards are formed partly on the expectations of significant others, and partly on one's own reflection on prior experience. Importantly, when personal standards are fulfilled, the individual experiences self-satisfaction and self-approval, characterised by the experience of positive valence emotions whereas, if personal standards are not met, the individual experiences negative valence emotions. As such, one can argue that it is performance standards that explain students' academic performance, and positive and negative affect in studying is a mere reflection on their fulfilment. Therefore, the relationship between personal standards in learning and positive and negative affect should be formally tested in future research.

Moreover, the *social cognitive theory of self-regulation* (Bandura, 1991) posits that people base their performance standards, judge their own learning progress and self-regulate own behaviour using two comparison techniques: a *social referential comparison* technique (i.e., comparison against a selected reference group like peers) and *self-comparison* technique (i.e., comparison against own prior performance to satisfy the need for progressive improvement) (Bandura, 1991). As such, the fulfilment of personal standards is determined by the individual's

dominating comparison technique. Thus, if own performance is judged mainly using self-comparison technique, individuals are more likely to fulfil their personal standards as the control is within the person, and hence are more likely to experience positive affect in studying. In contrast, if own performance is mainly judged using social reference comparison technique, the fulfilment of personal standards is subject to the performance of others, and hence individuals have less control over it and may experience more negative affect in studying. Therefore, future research should also examine whether students' tendency for evaluating their own performance using either of the comparison techniques explains positive and negative affect in studying in addition to the explanatory variables identified in this research.

A further limitation of Study 1 and Study 5 is the participant inclusion criteria. Only students who had academic performance for both examinations and coursework assessments were included in the final samples. As such, students whose subject knowledge was assessed only through one particular type of assessment, like coursework (e.g., educational studies), were underrepresented.

This leads to the question as to whether preference for a particular type of assessment can moderate the relationship between positive and negative affect and academic performance. For example, if students have a preference for writing essays, this could increase their positive affect in studying and, vice versa, if they don't like writing essays they may

experience higher negative affect and consequently put less effort into studying and get lower grades. Therefore, future research should aim to measure and control for the assessment preferences.

As with any cross-sectional research, Study 1 and Study 5 cannot imply causation between psychological variables in the model and learning progress. The results of both studies are only suggestive of the causal relationship. As such, future research should aim to test the proposed model longitudinally. A longitudinal design in addition will allow examining the stability of the proposed structures (i.e., trait motivation and metacognition) and processes (i.e., approaches to studying, positive and negative affect in studying, evaluation anxiety and the use of creative cognition). In study 5 the variables were conceptualised as structures or processes based on the theory, variable characteristics, variable stability and domain dependence. However, it was impossible to determine whether proposed structures are in fact more stable than proposed processes, which can also display relative stability.

The other limitations of this Ph.D. research are specific to each study and therefore will be only briefly summarised here. The remaining limitations for Study 1 include the weak test of the semester phase moderating effect on the relationship between positive and negative affect and approaches to studying. This study was largely exploratory and based on its results; future research should have a stronger test of moderation. This can be achieved by measuring positive and negative affect multiple

times throughout the semester. Measuring positive and negative affect longitudinally will also enable researchers to examine the dynamic nature of the relationship between affect and academic performance and the mechanisms underlying affective shifts i.e., rapid shift between negative and positive affect that allows an individual to benefit from adaptive functions of each affective state.

There are also a few specific limitations to Study 2 and 3. Use of Creative Cognition Scale (UCCS) derived from a Cognitive Processes Associated with Creativity (CPAC) scale, however, the extent to which the two scales converge was not tested. As such, it is impossible to determine whether the two scales measure the same or somewhat different constructs. Therefore, future research aiming to further develop the UCCS scale should examine the correlation between UCCS and CPAC. Furthermore, the UCCS's temporal stability should also be assessed, as it will determine whether the UCCS is suitable for monitoring change in the frequency of deploying the creative cognitive ability to an endeavour in achievement context.

The UCCS scale also omitted items measuring incubation, which, it is argued, is one of the important processes in creative thinking. The reasons for not including any item from the CPAC incubation subscale into the new UCCS is that firstly, the CPAC's incubation subscale lacked reliability. Secondly, the incubation process is an unconscious cognitive process, which is different from all other creative cognitive strategies

measured by the UCCS. There is no evidence that people can engage in incubation at will, as they can, for instance, engage in brainstorming. Therefore, it is unclear if incubation can be measured reliably as a domain specific habit and as such, was not assessed by the new UCCS.

There is also one key limitation specific to Study 4. In Study 4 the effect of the potential confounding variables on the relationship between the use of creative cognition and positive affect was not controlled. One such variable is intrinsic motivation. Intrinsic motivation was found to moderately–strongly correlate with the tendency to use creative cognition and also with positive affect in studying (Study 3). According to the self-determination theory, humans are "[…] active, growth-oriented organisms, that innately seek and engage challenges in their environment, attempting to actualise their potentialities, capacities and sensibilities" (Ryan & Deci, 2004, p. 8). As such, if people freely decide to use their creative cognition in exploring into a venture, they will tend to be more intrinsically motivated, enjoy the activity, and hence will be more likely to experience a heightened positive affect throughout and after the endeavour. Therefore, it is impossible to eliminate the possibility that the reciprocal relationship between the use of creative cognition and positive affect could be due to students' intrinsic motivation. As such, future research should test the proposed reciprocal model statistically controlling for the effect of intrinsic motivation.

6.4   Implications

Despite each study's limitations, the current Ph.D. research adds a unique contribution to our understanding of how psychological variables affect students' learning in Higher Education. In Studies 1 and 5 the results of correlation analyses showed that the deep approach to studying did not correlate with academic performance. The literature review indeed revealed that the deep approach was rather inconsistent in its relationship with academic performance. Some studies found a positive relationship between the deep approach to studying and academic performance (Burton & Nelson, 2006; Diseth, 2007; Huws et al., 2009), whereas others failed to do so (Diseth & Kobbeltvedt, 2010; Reid, Duvall, & Evans, 2007).

One possible explanation for the observed lack of the relationship between the deep approach and academic performance can be that deep learners are ineffective in allocating their study time and effort. Kember et al. (1995) found that deep learners spent less time studying than surface learners. This can be partially attributed to the effectiveness of the deep approach. However, dedicating less time would be unlikely to result in high academic performance even if the approach to studying is initially effective.

Furthermore, Minbashian et al. (2004) also found that deep learners were less detailed in their answers on examination questions and got lower grades as a result. The authors found that students who were

high and low on the deep approach tend to provide less quantity of answers i.e., sacrifice factual/detailed presentation over the demonstration of the overall understanding of the topic. The current Ph.D. research did not look at students' levels of the deep approach per se, nevertheless, the lack of the relationship between the deep approach and academic performance can be partially attributed to the trade-offs students make between quality and quantity of answers.

In contrast to the deep approach, strategic and surface approaches to studying moderately correlated with academic performance. The strategic approach correlated positively, whereas the surface approach correlated negatively with both examination and coursework performance. These results are in line with the majority of the previous research findings (e.g., Burton & Nelson, 2006; Diseth & Kobbeltvedt, 2010; Diseth, 2007). However, both approaches to studying failed to account for any variance in academic performance when controlling for prior academic performance.

One possible explanation for the failure of strategic and surface approaches to studying to explain academic performance is that they moderately correlated with positive and negative affect, respectively. Thus, the strategic approach positively correlated with positive affect and as such, positive affect in studying was partially overlapping and was a stronger correlate of academic performance. In the same manner, the surface approach to studying positively correlated with negative affect

and as such, negative affect in studying was partially overlapping and was a stronger correlate of academic performance.

With regards to the relationship between approaches to studying and other psychological correlates of learning, the results of the structural equation modelling identified trait intrinsic motivation as a strong correlate of the deep approach to studying, and adaptive metacognition as a strong correlate of the strategic approach to studying. This can be due to the conceptual differences between the two adaptive approaches. Biggs, Kember and Leung (2001) argued that the deep approach to studying conceptually describes the way students engage with learning material, whereas the strategic approach to studying conceptually describes students' organisation of their study time and resources. Consequently, students who have the ability to refrain from immediate reactions in difficult situations, set their minds for problem solving, and set adjustable study goals prefer the strategic approach to learning over the deep approach. This is in contrast to students, who are purely interested in studying and are guided mainly by curiosity rather than other explicit study goals. These students are likely to seek mastery of the subject and therefore are likely to adopt the deep approach over the strategic approach. Importantly, the role of the adaptive metacognition in the development of students' approaches to studying was corroborated for the first time.

Even though motivation and adaptive metacognition explained which approach to studying students were likely to adopt, the tendency to use creative thinking in learning was an overall stronger correlate of two adaptive approaches to learning. Furthermore, trait intrinsic motivation and adaptive metacognition also had an indirect effect on adaptive approaches to studying through the tendency to use creative thinking. Thus, intrinsically motivated students who also had adaptive metacognition were likely to use divergent and convergent thinking, metaphorical and analogical thinking, perspective taking and visualisation in studying. This enabled them to experiment with ideas, generate new ideas and form unusual relationships between ideas, which, in its turn, facilitated the development of adaptive learning strategies.

In contrast to deep and strategic approaches to studying, the surface approach to studying was explained by maladaptive metacognition, which also had an indirect effect on surface approach through evaluation anxiety. This suggests that students, who extensively worry and believe that worry helps them to cope with academic demands and who also lack confidence in their own cognition, are likely to perceive the study environment (in particular assessments) as a threat. As a result, students with maladaptive metacognition are more likely to focus on the danger of failing assessments as a way of preventing undesired outcome (Wells & Matthews, 1996) and therefore, will experience higher evaluation anxiety. Being anxious deprives students of the cognitive

resources necessary for effective processing of learning material (e.g., attention is directed towards the threat rather than learning), which forces students to engage with a cognitively less demanding strategy like rote-learning i.e., adopt the surface approach to studying.

Trait extrinsic motivation was also hypothesised to explain the surface approach to leaning, however results indicated that trait extrinsic motivation actually prevented the surface approach. Thus, extrinsically motivated students who were driven by the desire to attain external rewards or by the dictates of others were likely to refrain from maladaptive learning strategy. As such, trait extrinsic motivation is not necessarily a maladaptive form of motivation through and through.

However the direct effect was rather small, and the cumulative undermining indirect effect (through evaluation anxiety) on learning behaviour was stronger. This indicates that extrinsic motivation is not limited to the avoidance of failure that leads to evaluation anxiety. In some cases where evaluation anxiety is lower, extrinsically motivated students are more likely to be concerned with obtaining the best possible grade rather than avoiding failure. As such, trait extrinsic motivation is likely to assist with developing effective learning strategies, particularly the strategic approach to studying.

The results of a correlation analysis indeed supported a positive relationship between adaptive approaches to studying and trait extrinsic motivation; and showed no support for the relationship between the

surface approach and trait extrinsic motivation. Nevertheless, the relationship between adaptive approaches and trait extrinsic motivation was much weaker than that with trait intrinsic motivation.

The indirect effect of trait extrinsic motivation that leads to surface learning (mediated by evaluation anxiety) was stronger than direct preventative effect. As such, results strongly indicated that it is not motivational orientation per se that undermines adaptive learning, but it is a fear of failure (failure to reach desired goal) stemming from extrinsic motivation, that leads to elevated anxiety and threat monitoring behaviour. Being anxious deprives students of the necessary cognitive resources, which forces them towards rote-learning.

However, none of the approaches to studying explained students' academic performance. One of the main findings of this Ph.D. research is that positive and negative affect in studying were stronger correlates of students' learning and academic performance than approaches to studying. Understanding why emotions explain academic performance is paramount to understanding students' learning in Higher Education.

Negative affect was found to explain lower examination performance and GPA grades when measured in the second half of a semester, whereas positive affect was an overall stronger correlate of all measures of academic performance. These findings are well accounted for by the *control-process* theory (Carver & Scheier, 1990, 2001), the *mood-as-input* theory (Martin et al., 1993), the *broaden-and-build* model of

positive emotions (Fredrickson, 1998, 2001), and the *social cognitive theory of self-regulation* (Bandura, 1991).

Generally, there are two accounts for the undermining effect of negative affect and the facilitating effect of positive affect on academic performance. On the one hand, according to the mood-as-input theory (Martin et al., 1993), students who experience negative emotions in studying are likely to interpret their emotions as a sign of disliking the activity and disengage faster from studying. This implies that students spend less time, dedicate fewer resources and put less effort into leaning. The lack of these efforts ultimately leads to lower academic performance. On the other hand, students who experience positive affect in studying are likely to interpret their emotions as a sign of enjoying the activity and dedicate more time and put more effort into studying. This ultimately leads to better learning and academic performance. Thus, positive and negative affect motivates students' to direct study efforts or withdraw them.

From a cognitive perspective, the broaden-and-build model (Fredrickson, 1998, 2001) explains that students who experience negative emotions in studying lack social, physical, psychological and cognitive resources and therefore cannot learn effectively. They also have poor attention and thought-action repertoires that are important for learning. As such, negative affect prevents students form learning effectively and therefore they perform poorly. In an opposing manner, students who

experience positive affect have more social, physical, psychological and cognitive resources and therefore learn more effectively. This ultimately leads to better learning and academic performance.

The second account for the effect of emotions on learning is proposed by the control-process theory (Carver & Scheier, 1990, 2001), which posits that students' experience of positive and negative affect in studying is a subjective judgement of one's own academic progress. Thus, students who experience negative affect in studying perceive their progress slower than desired and are not satisfied with their level of knowledge. In contrast, students who experience positive affect in studying perceive themselves as progressing faster than anticipated and are satisfied with their learning progress and level of knowledge.

In the same manner, the social cognitive theory of self-regulation (Bandura, 1991) advocates that performance standards play a key role in self-regulated behaviour. Thus, when personal standards are not met, students feel negative emotions, whereas when personal standards are fulfilled, students feel positive emotions. As such, students' positive and negative affect in studying indicate how well students are progressing in their learning and therefore explain academic performance.

Importantly, students' subjective judgement of learning progress (through positive and negative affect) seems to align with the objective judgement of their learning progress (academic performance). This could be due to the influence environment has on students' judgement of what

is an acceptable level of progress. The environmental standards that a student has to adhere to are set through the pace of delivering new information, modules' learning outcomes, teachers' expectations and assessment criteria. These environmental influences steer a student's progress reference value and performance standards to match the environmentally imposed progress reference value and performance standards. The environmentally imposed progress reference value and performance standards are also reflected in the assessment criteria. As such, there is an alliance between the external and internal progress reference values and performance standards. Therefore, positive and negative affect in studying reflects whether students believe they have achieved an expected speed of leaning and level of knowledge.

However, not every student who is considered to be underperforming will experience negative affect, and not every student who is perceived as performing well will experience neutral or positive affect. For example, for one student a C grade can be a joy, while for another is a disaster. Therefore, students' affect in studying should be considered in relation to their academic performance. Knowing students' current affect in studying and prior academic performance enables more accurate estimation of their learning progress reference value and their performance standards and as such, enables more accurate estimation of their future academic performance.

The results of Study 5 revealed that negative affect in studying was mainly explained by maladaptive metacognition, which also had an indirect effect on negative affect in studying through evaluation anxiety. As such, students who hold maladaptive metacognitive beliefs are likely to perceive the study environment (in particular assessments) as a threat. They are predisposed to focus on the danger of failing assessments and hence experience evaluation anxiety. This leads to ineffective learning, and consequently, to a slow progress and associated with that negative affect in studying.

Nevertheless, negative affect in studying was an overall weak correlate of students' academic performance. In Study 1 negative affect explained academic performance only when measured in the second half of a semester and in Study 5 it did not explain it at all. Importantly, none of the variables in the maladaptive-negative submodel that were hypothesised to undermine academic performance accounted for any significant portion of variance in academic performance. Even though negative affect in studying was a weak and rather inconsistent correlate of academic performance and is considered unsuitable for intervention, it still can be used as an effective screening tool for identifying students who are at risk of underperforming and who will benefit the most from intervention. Conclusively, the results of this Ph.D. research strongly indicate that intervening on students' maladaptive metacognition,

evaluation anxiety, the surface approach to studying and negative affect is likely to be ineffective.

Positive affect in contrast was an overall stronger correlate of academic performance. The results of both the structural equation modelling and mediation analyses indicated that positive affect explained academic performance even when controlling for the effects of prior academic performance and other psychological correlates in the comprehensive, chained mediation model. Positive affect also mediated the effect of the use of creative cognition, trait intrinsic motivation and adaptive metacognition on learning and academic performance.

Adaptive metacognition had a direct effect on positive affect and indirect effect through the use of creative cognition in studying, whereas trait intrinsic motivation had an indirect effect on positive affect through the use of creative cognition in studying. Thus, students who are interested in studying, and also have well structured learning goals and a mind set for problem solving, are likely to use divergent and convergent thinking, metaphorical and analogical thinking, perspective taking and visualisation strategies when solving academic problems and studying in general. This, in its turn, assists with faster/better learning, which leads to the experience of positive affect that facilitates students' academic performance.

Importantly, results strongly indicated that there is a longitudinal reciprocal relationship between positive affect and the tendency to use

creative cognition. This reciprocal relationship can be interpreted with reference to well-established theories and models. On the one hand, the longitudinal relationship from positive affect to the use of creative cognition is consistent with the broaden-and-build theory of positive emotions (Fredrickson, 1998, 2001) and the mood-as-input model (Martin et al., 1993). In combination they predict that students who experience positive emotions in studying build and broaden their attention and thought-action repertoires, tend to enjoy the learning tasks more, and hence use their creative cognition in studying more intensely and for longer periods of time.

On the other hand, the longitudinal relationship from the use of creative cognition to positive affect is consistent with the control-process model of self-regulation of intentional behaviour (Carver & Scheier, 1990, 2000) and with the self-determination theory (Deci & Ryan, 1985; Ryan & Deci, 2000). The control-process model (Carver & Scheier, 1990, 2000) predicts that students who use more creative cognition in studying make faster progress in learning and hence experience more positive affect. The self-determination theory in addition (Deci & Ryan, 1985; Ryan & Deci, 2000) predicts that the choice to engage creatively with learning tasks empowers students and enhances their self-determination and intrinsic task-motivation, and hence results in heightened positive affect throughout the endeavour and thereafter.

The other most important theoretical implication of this Ph.D. research is that adaptive-positive structures and processes were superior to maladaptive-negative structures and processes. The strength of the correlation between the variables in the adaptive-positive submodel and the maladaptive-negative submodel strongly indicated that the two submodels were orthogonal and not inverse of each other.

This counterintuitive relationship implies that the reduction of maladaptive-negative structures and processes does not automatically lead to the increase of adaptive-positive structures and processes. This basic understanding of the relationship between adaptive-positive and maladaptive-negative structures and processes has important practical application for designing an intervention. Hence, positive affect, the use of creative cognition, trait intrinsic motivation and adaptive metacognition were the only variables that satisfied the "shortlisting" criteria for prospective educational intervention. Even though negative affect in studying was a weak and rather inconsistent correlate of academic performance and as such, was considered unsuitable for intervention, it can still be used as an effective screening tool for identifying students who are at risk of underperforming and who will benefit most from intervention.

6.5   Applications

This Ph.D. research has a strong application in areas of education and educational interventions. The proposed chained mediation model, which comprises of maladaptive-negative and adaptive-positive structures and processes, provides a solid empirical foundation for designing an effective educational intervention. According to the results of this Ph.D. research and in particular the comprehensive, chained mediation model of academic performance, the educational interventions and programmes should focus predominantly on psychological structures and processes that facilitate better learning: positive affect in studying, the use of creative cognition in studying, trait intrinsic motivation and adaptive metacognition.

On the one hand, positive affect in studying has been identified as the overall strongest psychological correlate of academic performance. Even though the effect of positive affect on academic performance was small, it was nonetheless significant. Therefore, the intervention should be directed towards enhancing students' positive affect in studying.

Individuals' emotions vary from situation to situation in a way that when something pleasant happens people feel good/pleasant emotions, whereas if something unpleasant happens people feel negative emotions. As such, on the one hand, intervention should directly target positive affect in studying by infusing enthusiasm in students. This can be

done directly through challenging students intellectually and providing encouraging supervisory support.

However, positive affect is hard to stimulate directly because an individual's response in different situations and one's own sensitivity to the emotive stimuli are determined by temperament (Clark & Watson, 1999) and therefore are inbred (Rothbart et al., 2000). As such, despite the variation in the emotional responses in different situations, the overall emotional experience is relatively stable over time (Watson & Walker, 1996). This implies that each student is predisposed to feel either positive or negative emotions across situations and times despite situational dissimilarities.

Positive and negative affect also relates to personality traits of neuroticism and extraversion in a way that people who are high on neuroticism experience negative affect more frequently and strongly, whereas people who are high on extraversion experience positive affect more frequently and strongly (Gomez, Cooper, McOrmond, & Tatlow, 2004). This also places an obstacle to interventions aiming to facilitate positive affect in studying directly.

Even though positive affect is a function of temperament and personality, this innate predisposition does not preclude the possibility to change an individual's affectivity. Affective response can change, for example, as a result of life experiences and maturation. As such, it is possible to intervene directly on positive affect, but it is likely to be time

consuming and have a little effect. Consequently, direct interventions are likely to be cost ineffective and therefore unsuitable for interventions taking place in Higher Education institutions.

On the other hand, the chained mediation model of academic performance provided a strong indication for adaptive-positive structures and processes to be better "candidate" variables for intervention. Therefore, intervention should focus on the development of adaptive metacognition, in particular, the ability to set a feasible hierarchy of goals that can be adapted and changed in response to the changes in educational environment and circumstances. Having adaptable goals will prevent students from experiencing prolonged negative affect that can lead to disengagement from studying. Furthermore, having adaptive metacognition will facilitate creative cognition and as such, will enhance an exploration of all possible options that can be effectively implemented in a challenging situation.

Trait intrinsic motivation is also a potential "candidate" variable for intervention. However, intrinsic motivation is also hard to facilitate directly. Research strongly indicated that environment has a strong effect on intrinsic motivation. Therefore, it is hard to stimulate intrinsic motivation without implementing environmental changes like providing students with the choice for actions (e.g., Cordova & Lepper, 1996; Reeve, Nix, & Hamm, 2003; Zuckerman, Porac, Lathin, & Deci, 1978). In the case of academia, choice for action infers allowing students to

study only topics that they are interested in, and also giving them control over assessments e.g., type of assessments, time of assessments.

However, choice may not always facilitate intrinsic motivation. Research found that the cultural background moderates the relationship between choice and intrinsic motivation. Thus, individuals from a collectivistic culture in general prefer authoritative in-group members to make choices for them, whereas individuals from an individualistic culture prefer making choices for themselves (e.g., Markus & Kitayama, 1991; Savani, Markus, & Conner, 2008). As such, it is highly complex to facilitate intrinsic motivation through change in multicultural societies similar to the participating university. Still, the change in a university's culture from individualistic to collectivistic is possible and will lead to a higher intrinsic motivation in studying, particularly on the tasks where students have no personal choice like compulsory subjects and particular assessments e.g., examinations and essays (Hagger, Rentzelas, & Chatzisarantis, 2014).

Conclusively, interventions aiming to enhance intrinsic motivation in students in Higher Education would have to include change in their perceptions of the university's culture, or changing the culture itself. In both cases an intervention of this sort will be time consuming and lead to limited improvements. Furthermore, the relationship between trait intrinsic motivation and positive affect was mediated by the use of creative cognition and positive affect mediated the relationship between

trait intrinsic motivation and academic performance. As such, intervening on intrinsic motivation is likely to be cost ineffective and therefore is unsuitable for Higher Education institutions.

Overall, intrinsic motivation, positive affect in studying, and to a lesser extent adaptive metacognition, are hard to intervene on directly. As such, the most promising direction for intervention is to focus on stimulating students' use of creative thinking in studying. Trait intrinsic motivation and adaptive metacognition had an indirect effect on positive affect in studying through the use of creative cognition. The use of creative cognition was also the strongest correlate of positive affect and had a longitudinal reciprocal relationship with it. Taking into consideration that any person can use creative cognition (i.e., divergent, convergent, metaphorical and analogical thinking, perspective taking and visualisation) and that it is an effective problem solving strategy, the use of creative cognition can be considered a form of coping. Being a form of coping, creative cognition can be taught.

Consequently, creative cognition appears to be the best candidate variable for intervention. As such, interventions aiming to improve students' learning and academic performance should focus on teaching students to generate ideas, find relationships between ideas, discriminate between ideas and evaluate ideas for practicality and feasibility, either directly through workshops or indirectly through curricula and assessments.

Well-designed training programmes that foster the use of creative cognition in studying are expected to increase students' positive affect in studying, which will lead to enhanced social, physical, psychological and cognitive resources and as such, will foster longer engagement in studying and better learning. This, of course, is conditional on whether future studies will corroborate the use of creative cognition – positive affect link using experimental and randomised trials study designs.

The other benefit of intervening on students' creative cognition is that it will also facilitate intrinsic motivation. It is easier to intrinsically motivate students to be creative or to use creative cognitive strategies in studying than to increase their intrinsic motivation in studying per se. In simple words, "authority"/teachers can enforce intrinsic motivation when the requirement is to be creative. On the one hand, the order to be creative increases intrinsic motivation in collectivists cultures, since the choice is made by "authority". On the other hand, the order to be creative also increases intrinsic motivation in individualists cultures, since it provides the choice about the way people can be creative. As such, interventions designed to facilitate the use of creative cognition in studying are likely to enhance students' intrinsic motivation for learning.

6.5.1   Outline of the prospective intervention and its benefits

The use of creative cognition in studying was identified as a primary variable for intervention. Therefore, future research should focus

on developing and testing interventions/programmes directed at facilitating students' creative thinking. This section outlines the prospective intervention, which it builds on the results of all five studies presented and tackles the broad and somewhat paralysing issue of improving students' academic performance. This prospective intervention is characterised by attention to measurement, conceptual modelling, and statistical modelling of longitudinal data.

It is vital to consider the timing of the intervention in order to maximise its impact. Interventions aiming to facilitate the use of creative cognition in studying should be implemented in the beginning of a semester. Implementing this intervention early in the semester will enable students to develop a habit for using creative cognitive strategies in studying as a form of coping with Higher Education challenges.

Two important considerations should be taken into account when designing the intervention. Firstly, in order to have a long lasting effect, the intervention should be interactive and practice based. Thus, intervention design should ensure that students actively engage with learning tasks and are active participants in their learning. This will increase their perceived agency and personal causation over studying activities and as such, will increase their autonomy and develop competence in studying. Secondly, an intervention should comprise of several sessions to enable practice and mastery of using creative cognition strategies in studying.

The main objectives of the proposed creativity training intervention are (a) to help students realise the positive consequences of using creative cognition on emotions and performance, (b) to teach students to use their creative cognition in simulated learning tasks and (c) to help students extend the use of their creative cognition to the learning tasks they tackle in everyday academic endeavours. These aims are addressed in three stages of the intervention. The proposed structure of the intervention is expected to have the optimal effect on students' learning.

The first stage of the programme is fundamentally educational. At this stage students are taught about the cognitive processes associated with creativity, or simply creative cognition, and what strategies can be used to facilitate creative output when tackling challenging problems.

The second stage, is practiced-based training. At this stage students should practice using creative cognitive strategies in working with sets of problems (any task at hand) that are not specifically related to academia. This will provide practice to students in using creative cognition for the purpose of generating creative ideas and applying their creative ideas to problem solving. The tasks should be directed at teaching students to examine the practicality and feasibility of their creative ideas. A good technique for this is to have group sessions in which students can share their creative ideas and receive critical feedback

from peers. Group sessions will also foster students' engagement with the intervention.

The third stage, is also practice-based. At this stage students should practice their use of creative cognition in solving study-related problems e.g., preparing and structuring arguments for essays and presentations, organising study material for examination preparation, selecting subjects for dissertation. Learning tasks at this stage should be designed in a way that teaches students how and when to use a particular cognitive process or strategy in order to come up with a creative and feasible solution/idea, apply it in a context, and present it effectively to others.

Intervening on creative cognition is likely to result in learning improvement as the proposed creativity intervention is using an approach that is conceptually clear, methodologically solid, and easy to apply across contexts and institutions. Learning how to deploy one's own creative abilities when studying, even if this does not directly result in better grades, will make students feel more interested, energised, and engaged in learning. Because of this emotional enhancement, students will learn better, and hence improve their academic performance.

The proposed creativity intervention also has far reaching benefits beyond Higher Education. The main aims of Higher Education are focussed on preparing students for their professional career in a rapidly changing work environment, and equipping students with skills and

certain competences that will enable career success. However, universities have a hard time predicting which sets of knowledge and skills will be needed in the future.

Moreover, Higher Education institutions increasingly realise that knowledge alone cannot enable individuals to successfully solve novel and increasingly heuristic, and ill-structured problems. These problems are usually problems with no clear path to a solution, problems with multiple paths to a solution, problems with no solution, problems with unstated constraints, and problems to which no general rule applies (e.g., Sternberg, 2006). Therefore, nowadays, creative ability can be seen as paramount to achievement in complex work endeavours because it enables individuals to imagine, synthesise, connect, invent and explore (Sternberg & Lubart, 1995). Conclusively, the use of creative cognition is the method of choice – if not the only one – to tackle heuristic types of problems with a reasonable chance of success.

Despite all the benefits of creativity for success in education and generally in life, the development and practice of students' creative ability has rarely been an explicit objective of learning, with the exception of a small number of inherently artistic disciplines like architecture and fine arts. Assessment criteria still rarely mention 'creativity' of ideas as they are presented in essays, coursework, and final-year dissertations. Curricula are still largely concerned with delivering knowledge as a stand-alone entity. Higher Education, in general, appears to be hoping

that graduates will find a way by themselves to adapt and apply the acquired knowledge in unexpectedly new work situations. As such, this research and the proposed intervention provide an opportunity for starting to envision 'creativity' as a new and distinct learning objective.

6.6   Directions for Future Research

This research opens new opportunities and directions for the future research in education. Most of the directions for future studies arose from the research limitations that were discussed earlier in this chapter.

One of the main limitations in this research was the use of academic performance as a measure of learning progress. Even though academic performance has a number of advantages, future research will benefit from assessing students' subjective evaluation of their own learning progress and performance standards. Research should examine whether positive and negative affect explains subjective judgement of learning, and whether the relationship between positive and negative affect in studying and academic performance is mediated by students' performance standards.

Future research should also test the chained mediation model of academic performance using different assessments types. In this research, only Study 1 examined the effect of psychological variables separately for examinations and coursework. The relationship between positive and

negative affect with two types of assessments was slightly different. Therefore, future research should aim to test whether the chained mediation model will hold for both examination and coursework performance.

When testing the model separately for examination and coursework, the two important aspects should be considered. Firstly, in order to obtain a more accurate result, it is important to control for measurement error in both outcome variables (examination and coursework performance). The coursework performance presented as latent variable can include grades on essays, reports and portfolios. The examination performance presented as latent variable can include grades on multiple choice tests, short essay-type examinations and practical problems solving examinations. Secondly, when testing the chained mediation model separately for examination and coursework performance, research should control for assessment preference. Students develop preferences for the different types of assessments and therefore, they may perform better on the assessments they like.

Furthermore, future research should aim to employ longitudinal design to further advance our understanding of the relationship between proposed structures and processes in the model, and learning and academic performance. A longitudinal design with at least two-waves, will firstly enable to evaluate the stability of proposed structures and processes. Secondly, it will help to estimate causal relationships between

the variable in the model. Thirdly, knowing the causal relationships between variables in the chained mediation model will allow the development of the model further by including the reciprocal relationships between the variables (e.g., the use of creative cognition and positive affect).

Research should also examine the dynamic nature of positive and negative affect in studying. Bledow and co-workers (2013) developed and tested a model of optimal alternation of affective states at work. They argued that negative affect fosters task creativity if it is high at the onset and then sharply decreases while positive affect sharply increases. The affective shift constitutes the phoenix model. By analogy, it is possible that the same happens in the learning context in relation to the tendency to use creative cognition as well as in relation to academic performance. As such, to better understand the effect of emotions on learning and other psychological correlates of learning, future research should aim to detect and test the phoenix or other forms of affective shift. The preliminary testing of such models in education would require at least two measures of affect and three measures of academic performance. In total the simplest test would include at least five assessment points over the two semesters.

The new UCCS scale development also opened a new way of studying creativity in education. It was proposed that it is not the creative ability per se that is important for learning, but rather one's ability to

deploy one's own creativity, or more precisely, one's own creative cognition to an endeavour in achievement context. The new UCCS measures just that and conceptualises the use of creative cognition as a domain specific disposition. However, more research is needed to examine to what extent the new UCCS scale converges with other measures of creativity. Other measures of creativity should be selected based on the aspects of creativity they measure i.e., person, product, press, and process.

Furthermore, UCCS measures somewhat different constructs than its "parent" CPAC scale. However, the extent to which the two scales converge was not formally tested. Therefore, future research concerning scale development should examine the relationship between the two scales.

Additionally, the UCCS scale was tested only in a student sample. At present it is unknown if the scale adequately captures the frequency of use of creative cognition in other domains of activity (e.g., work), and is suitable for use in other populations (e.g., workers). Therefore, future research should test the UCCS in other populations that are either inherently creative (have explicit creativity-performance link and judges creativity as normative behaviour) or not.

Most importantly, this Ph.D. research led to the development of a framework for designing educational interventions aiming to improve students' learning. The outline and benefits of one such intervention were

described earlier in the chapter. As such, the main direction for further research is to examine to what extent the proposed intervention meets expectations in improving students' learning and academic performance.

The most appropriate design for testing the effect of the intervention is a randomised control trial where all participants are randomly allocated to two groups: one receiving the proposed intervention and the other receiving general consulting sessions. Students' use of creative cognition in studying and positive affect in studying should be measured at the start of the intervention, immediately after the intervention, and three months after the intervention. These will allow examining whether the intervention was successful in facilitating students' creative cognition and also whether there was a long lasting effect.

Furthermore, students' academic performance across all modules should be recorded before and after the intervention. This will allow examining the effect of the intervention on students' learning and academic performance. The additional measure of the effectiveness of the proposed creativity intervention can also be evaluated in relation to how creative students' work is. The assessments of the creativity of an academic work can be done using the consensual assessment techniques (Amabile, 1996), which showed to consistently provide valid and reliable ratings of product creativity (Baer & McKool, 2009).

Conclusively, there are various directions for further research. Probably the most important two are the refining of the chained mediation model of academic performance and testing the effectiveness of the proposed intervention.

6.7   Conclusions

Overall, this Ph.D. research adds a unique contribution to the knowledge by providing empirical evidence about the importance of adaptive-positive and maladaptive-negative structures and processes in students' learning and academic performance. The core findings of all five studies can be summarised in five main unique contributions.

Firstly, this Ph.D. research indicated for the first time that positive and negative emotions students experience in studying are linked prospectively to all facets of academic performance. Positive affect was an overall stronger correlate of academic performance than negative affect, and they were both superior to approaches to studying and evaluation anxiety.

Secondly, this research proposed a new framework for studying creativity in education. It was proposed that in relation to studying, the ability to use creative thinking strategies is more important for successful learning than creative ability per se. Thus, it is a student's ability to apply their creative cognition to an endeavour in achievement context that facilitates learning and consequently academic performance. As such, this

conceptualisation of creativity opened novel opportunities for designing educational intervention aiming to improve students' learning.

Thirdly, the new UCCS measure of the use of creative cognition in studying was developed to assess a distinct construct i.e., the tendency to deploy creative thinking in studying. The UCCS was shown to be a reliable tool with good psychometric properties (i.e., convergent and discriminant validity) that was proposed to be a useful measure for monitoring change in the use of creative cognition in both longitudinal studies and studies involving the evaluation of creativity interventions/programmes.

Fourthly, this research was the first one to establish the longitudinal reciprocal relationship between positive affect and the use of creative cognition in an education context. On the one hand, the link from positive affect to the use of creative cognition has received robust empirical support and the finding that this relationship holds for students was a small addition to knowledge. On the other hand, the link from the use of creative cognition to positive affect has been under researched and has proven elusive. As such, finding that this relationship holds for students is an important addition to the current knowledge.

Finally, this research developed and tested the comprehensive, chained mediation model of academic performance, which provided a strong empirical foundation for designing educational interventions aiming to improve students' learning and academic performance. The

model comprised of adaptive-positive and maladaptive-negative submodels, and explained 90% of variance in students' academic performance. Prior academic performance and positive affect in studying were the only significant correlates of academic performance. As such, adaptive-positive structures and processes were superior to maladaptive-negative structures and processes in explaining students' learning and academic performance. Furthermore, the two submodels were found to be orthogonal, which advocates that educational interventions aiming to improve students' learning should focus on developing students' adaptive-positive structures and processes rather than on reducing maladaptive-negative structures and processes.

Overall, this Ph.D. aimed to increase researchers'/practitioners' awareness and interest in the newly developing field of Positive Educational Psychology. This new direction in educational research is concerned with examining positive psychological concepts within educational context and advocates practice of evidence-based positive educational interventions.

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LIST OF APPENDICES

Appendix 1: Ethical approval certificate

London Metropolitan University Psychology Department, Ethics Panel

I am pleased to say that the following PhD project;

"Evaluation and development of a trait-state model of approaches to studying and their relationships to academic performance: A three year follow-up study"

Researcher: Jekaterina Rogaten
Supervisor: Giovanni Moneta

Has received ethical approval to proceed,* providing that it follows the ethical guidelines used by the Psychology Department and British Psychological Society. The researcher is also responsible for conducting the research in an ethically acceptable way, and should inform the ethics panel if there are any substantive changes to the project that could affect its ethical dimensions, and re-submit the proposal if it is deemed necessary.

Signed:

Dr Chris Cocking (chair Psychology ethics panel)

c.cocking@londonmet.ac.uk

Date: 3/11/2010

* THIS IS AN UPDATED CERTIFICATE THAT ADEQUATELY ADDRESSES THE ETHICAL ISSUES RAISED IN THE PREVIOUS CERTIFICATE

3/11/2010

Appendix 2: Template for the letter of invitation (manor adjustments were made for each study)

Dear Student,

You are invited to participate in a research project that is conducted in the School of Psychology at London Metropolitan University. The participation in this research is voluntary but before agreeing to take part please read the following information on why this research is done and what are the procedures for taking part.

Title: **Evaluation and development of a trait-state model of approaches to studying**

The purpose of this study

Your volunteering to take part in this study will provide valuable information for understanding the relationship between students' approaches to studying, creativity, emotions, motivation and metacognition, and academic performance, and to widen our understanding of how people study and succeed in higher education. The knowledge obtained from this research is expected to lead to the improvement of university support programmes that are designed to help students to reach full academic potential.

How to participate

You will find a link to the online questionnaire at the end of this e-mail. Click on it and follow the online instructions. Within the framework of this project the research team will follow up your academic performance. You will be provided with intermediate debrief after filling in the questionnaire. The full debrief will be sent to your e-mail at the end of this project.

What is required of you

The questionnaire pack includes 15 questionnaires that you need to fill in. It will take approximately 30 minutes to complete.

Confidentiality and right to withdraw

Your confidentiality will be protected at all times. The data will be anonymised prior to statistical analysis and reports/publications writing. Partaking in this research is voluntary. You have a right to withdraw at any time you want prior, during, or after the participation.

How to participate

Please follow the link bellow to take part:

[link to the questionnaire]

Further information and concerns

If you have any questions with regards to your participation in this project or any queries concerning this study please do not hesitate to contact Jekaterina Rogaten or Dr Giovanni Moneta.

Project Investigator	*Project Supervisor*
Jekaterina Rogaten	**Dr Giovanni B. Moneta**
Ph.D. Student	Senior Lecturer
School of Psychology	School of Psychology
uniexperience@londonmet.ac.uk	**g.moneta@londonmet.ac.uk**
☎ 020 7320 1141	☎ 020 7320 2360

Investigator's statement

I have informed the participant in this e-mail of the nature and purpose of this study and have sought to answer their questions to the best of my ability. I have read, understood, and agree to abide by the Ethical Principles for Conducting Research with Human Subjects set out by the British Psychological Society in carrying out this study.

Confidentiality and right to withdraw

Your confidentiality will be protected at all times. The data will be anonymised prior to statistical analysis and reports/publications writing. Partaking in this research is voluntary. You have a right to withdraw at any time you want prior, during, or after the participation. If you wish not to continue your questionnaire and not to receive further emails from us, please click the link below, and you will be automatically withdrawn from UniExperience project.

[link to withdraw]

Appendix 3: Consent form

Thank you for deciding to take part in this research!

Before you can start **please read the following consent statements carefully.**

*Participant's Consent***:**

- ✓ I have read the project information provided in the invitation letter and consent form

- ✓ I have been informed of and understand the purpose of this study and its procedures

- ✓ I understand that my participation is voluntary, and that I can choose not to participate in part or all of the project

- ✓ I understand my right to withdraw at any time during or after my participation without being penalised or disadvantaged in any way

- ✓ I understand that I can ask for the data I provide to be removed from the study up to the point where it no longer becomes possible (e.g., once it has been anonymised)

- ✓ I understand that the information I provide will be treated in confidence by the investigator and that my identity will be protected at all times

- ✓ I understand that agreeing to take part means that I consent to:

  - ✓ Providing my demographic details (gender, age, etc.) in the understanding that any identifying information will be separated from the data I provide, so my anonymity will be maintained

  - ✓ The research team to follow up my academic performance

  - ✓ The use of the anonymised data I provide to be used in publications and/or conferences

Agree   **Disagree**

Appendix 4: Demographic data sheet

Sex: Male:_____   Female:_____

Age: _____

Country of birth: _____

Nationality (check more than one option if you have a dual citizenship):
_____ (1) UK
_____ (2) Other, please specify_____

If not a UK citizen, for how many years have you lived in the UK?
_____

Ethnic background (check only one group):
_____ Black
_____ Chinese
_____ Indian
_____ Japanese
_____ White, Caucasian
_____ Other, please specify_____
_____ Mixed, please specify_____

Marital Status:
_____ Single
_____ In a relationship
_____ Married
_____ Divorced
_____ Widowed
_____ Other, please specify_____

Do you **have children**?
_____ Yes   If yes, how many children live with you?
_____
_____ No

Do you **work**?
_____ Yes
_____ No

If yes, **how many hours** do you approximately work per week?
_____

Which **course of study** are you currently enrolled in? _____

At which **year level** are you currently enrolled?_____

Appendix 5: Use of Creative Cognition Scale (UCCS)

Following is a series of statements about personal preferences and behaviours. Please indicate how frequently you engage in each behaviour during your study. Please respond thinking of **your general studying experience and behaviour** across situations and times

1 Never   2 Rarely   3 Sometimes   4 Often   5 Always

1	I try to act out potential solutions to explore their effectiveness.	1	2	3	4	5
2	I find effective solutions by combining multiple ideas.	1	2	3	4	5
3	Incorporating previous solutions in new ways leads to good ideas.	1	2	3	4	5
4	While working on something, I try to generate as many ideas as possible.	1	2	3	4	5
5	If I get stuck on a problem, I try to take a different perspective of the situation.	1	2	3	4	5

Appendix 6: Approaches and Study Skills Inventory for Students (ASSIST), Short 18-Item Form

Please work through the following comments, giving your immediate response. In deciding your answers, think in terms of **your current experience and behaviour when you engage in study activities**, and choose one appropriate number according to the following scale:

1 Disagree   2 Disagree somewhat   3 Agree somewhat   4 Agree

1. Often I find myself wondering whether the work I am doing here is really worthwhile   1   2   3   4

2. When I am reading an article or book, I try to find out for myself exactly what the author means   1   2   3   4

3. I organise my study time carefully to make the best use of it   1   2   3   4

4. I concentrate on learning just those bits of information I have to know to pass   1   2   3   4

5. I look carefully at tutor's comments on course work to see how to get higher marks next time   1   2   3   4

6. Regularly I find myself thinking about ideas from lectures when I'm doing other things   1   2   3   4

7. I'm pretty good at getting down to work whenever I need to   1   2   3   4

8. Much of what I'm studying makes little sense: it's like unrelated bits and pieces   1   2   3   4

9. I put a lot of effort into studying because I'm determined to do well   1   2   3   4

10. When I'm working on a new topic, I try to see in my own mind how all the ideas fit together   1   2   3   4

11. I don't find it all difficult to motivate myself   1   2   3   4

12. Often I find myself questioning things I hear in lectures or read in books   1   2   3   4

13. I manage to find conditions for studying which allow me to get on with my works easily   1   2   3   4

14. Often I feel I'm drowning in the sheer amount of material we're having to cope with   1   2   3   4

15. Ideas in course books or articles often set me off on long chains of thought of my own   1   2   3   4

16. I often worry about whether I'll ever be able to cope with the work properly   1   2   3   4

17. When I read, I examine the details carefully to see how they fit in with what's being said   1   2   3   4

18. I often have trouble in making sense of the things I have to remember   1   2   3   4

Appendix 7: International Positive and Negative Affect Schedule - Short Form (I-PANAS-SF)

Please read the following adjectives in detail and think if you have those feelings. Please respond thinking of **your current experience and behaviour when you engage in study activities.**

	none	some	quite	very	very much
Alert	1	2	3	4	5
Upset	1	2	3	4	5
Inspired	1	2	3	4	5
Hostile	1	2	3	4	5
Determined	1	2	3	4	5
Ashamed	1	2	3	4	5
Attentive	1	2	3	4	5
Nervous	1	2	3	4	5
Active	1	2	3	4	5
Afraid	1	2	3	4	5

Appendix 8: Evaluation Anxiety Scale (EVAN)

Please read each of the statement below carefully, assessing the extent to which each statement applies to **your current experience and behaviour when you engage in study activities**. By referring to the scale for each item, select the number that corresponds to your choice:

1	**2**	**3**	**4**	**5**	**6**	**7**
Not at all true of me					**Very true of me**	

1	I perform best in situations when I know that my ability is not being judged.	1 2 3 4 5 6 7
2	I get anxious when I am given a homework assignment that challenges my ability to do well.	1 2 3 4 5 6 7
3	Situations that may reveal that I have low ability do not threaten me.	1 2 3 4 5 6 7
4	When I give a presentation in front of a class, I am afraid that others will find fault with what I am saying.	1 2 3 4 5 6 7
5	I try to avoid situations that are likely to reveal low ability.	1 2 3 4 5 6 7
6	I get anxious just prior to receiving the result of a test on which I was not certain of my performance.	1 2 3 4 5 6 7
7	I am often concerned that tests will not always be good indicators of my abilities.	1 2 3 4 5 6 7
8	I am often concerned that tests will reveal my academic shortcomings.	1 2 3 4 5 6 7
9	I often do not contribute to discussions because I am afraid that others will find fault in my comments.	1 2 3 4 5 6 7
10	I prefer homework assignments that follow exactly the format of problems that are presented in the textbook or the lecture.	1 2 3 4 5 6 7
11	I frequently worry about people's impressions of my ability.	1 2 3 4 5 6 7

12 I am not particularly threatened by situations   1 2 3 4 5 6 7
    that are likely to reveal low ability.

13 I am afraid that other people will conclude   1 2 3 4 5 6 7
    that I lack ability.

14 When I receive a paper back after evaluation,   1 2 3 4 5 6 7
    I don't read the comments because I'm afraid
    that they will be critical.

15 If I know that someone is making a judgment   1 2 3 4 5 6 7
    about my academic performance, it has little
    effect on me.

Appendix 9: Short Dispositional Flow Scale-2 (SDFS-2)

These questions relate to the thoughts and feelings you may experience during your studying. You may experience these characteristics some of the time, all of the time, or none of the time. Think about how often you experience each characteristic during your studying. Please respond thinking of **your general experience and behaviour during your study.** By referring to the scale for each item, select the number that corresponds to your choice:

1 Never   2 Rarely   3 Sometimes   4 Frequently   5 Always

1	I feel I am competent enough to meet the high demands of the situation	1	2	3	4	5
2	I do things spontaneously and automatically without having to think	1	2	3	4	5
3	I have a strong sense of what I want to do	1	2	3	4	5
4	I have a good idea while I am performing about how well I am doing	1	2	3	4	5
5	I am completely focused on the task at hand	1	2	3	4	5
6	I have a feeling of total control over what I am doing	1	2	3	4	5
7	The way time passes seems to be different from normal	1	2	3	4	5
8	The experience is extremely rewarding.	1	2	3	4	5
9	I am not worried about what others may be thinking of me	1	2	3	4	5

Appendix 10: Short Flow in Work Scale (SFWS)

Please rate each statement in terms of how true it is of you. Please respond thinking of **your general experience and behaviour during your study**. Please choose one letter for each question according to the following scale:

> **N- Never or almost never true of you**
> **S- Sometimes true of you**
> **O- Often true of you**
> **A- Always or almost always true of you**

1. Sometimes when I am working I become so absorbed that I am less aware of myself and my problems   N S O A

2. When I get really involved in my work my concentration becomes like my breathing…I never think of it   N S O A

3. When I am working I am so involved in it that I don't see myself as separate from what I am doing   N S O A

Appendix 11: Work Preference Inventory (WPI)

Please rate each statement in terms of how true it is of you. Please respond thinking of **your general experience and behaviour during your study**. Please choose one letter for each question according to the following scale:

> **N- Never or almost never true of you**
> **S- Sometimes true of you**
> **O- Often true of you**
> **A- Always or almost always true of you**

4.	I am not that concerned about what other people think of my work.	N S O A
5.	I prefer having someone set clear goals for me in my work.	N S O A
6.	The more difficult the problem, the more I enjoy trying to solve it.	N S O A
7.	I am keenly aware of the goals I have for getting good grades.	N S O A
8.	I want my work to provide me with opportunities for increasing my knowledge and skills.	N S O A
9.	To me, success means doing better than other people.	N S O A
10.	I prefer to figure things out for myself.	N S O A
11.	No matter what the outcome of the project, I am satisfied if I feel I gained a new experience.	N S O A
12.	I enjoy relatively simple, straightforward tasks.	N S O A
13.	I am keenly aware of the GPA (grade point average) goals I have for myself.	N S O A
14.	Curiosity is the driving force behind much of what I do.	N S O A
15.	I'm less concerned with what work I do than what I get for it.	N S O A
16.	I enjoy tackling problems that are completely new to me.	N S O A

17. I prefer work I know I can do well over work that stretches my abilities.   N   S   O   A

18. I'm concerned about how other people are going to react to my ideas.   N   S   O   A

19. I seldom think about grades and awards.   N   S   O   A

20. I'm more comfortable when I can set my own goals.   N   S   O   A

21. I believe that there is no point in doing a good job if nobody else knows about it.   N   S   O   A

22. I am strongly motivated by the grades I can earn.   N   S   O   A

23. It is important for me to be able to do what I most enjoy.   N   S   O   A

24. I prefer working on projects with clearly specified procedures.   N   S   O   A

25. As long as I can do what I enjoy, I'm not that concerned about exactly what grades or awards I can earn.   N   S   O   A

26. I enjoy doing work that is so absorbing that I forget about everything else.   N   S   O   A

27. I am strongly motivated by the recognition I can earn from other people.   N   S   O   A

28. I have to feel that I'm earning something for what I do.   N   S   O   A

29. I enjoy trying to solve complex problems.   N   S   O   A

30. It is important for me to have an outlet for self-expression.   N   S   O   A

31. I want to find out how good I can really be at my work.   N   S   O   A

32. I want other people to find out how good I really can be at my work.   N   S   O   A

33. What matters most to me is enjoying what I do.   N   S   O   A

Appendix 12: Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ)

This questionnaire is concerned with beliefs people have about their thinking and emotions in difficult situations. Listed below are a number of such beliefs that people have expressed. Please read each item and indicate how much you generally agree with it. Please respond **thinking of your general experience and behaviour** across situations and times. By referring to the scale for each item, select the number that corresponds to your choice:

1 Do not agree

2 Agree slightly

3 Agree moderately

4 Agree very much

1. In times of "feeling in the dumps" it's hard for me to regulate my low mood.   1 2 3 4

2. In difficult situations I quickly "rationalise" my fear by assessing cost and benefits of "confronting versus escaping".   1 2 3 4

3. I can easily divide important long-term goals into achievable and short-term sub-goals.   1 2 3 4

4. If things go really badly I tend to brood and dwell on my negative thoughts.   1 2 3 4

5. I feel that negative or anxious thoughts do not depict the reality – I regard them just as "events" which I have to evaluate.   1 2 3 4

6. I can prioritise my needs and formulate a hierarchy of goals.   1 2 3 4

7. When the "blues" overcomes me I tend to struggle with controlling my low mood.   1 2 3 4

8. I can stop any "negative thinking spirals" and focus on what I can do in the situation.   1 2 3 4

9. When I find it difficult to cope with a huge task I tend to tackle it in smaller steps. 1 2 3 4

10. I tend to overreact when things are really going wrong. 1 2 3 4

11. I tend to rationally evaluate unpredictable situations rather than getting anxious. 1 2 3 4

12. When progress becomes slow and difficult I can readily adopt a step-by-step approach to remove obstacles. 1 2 3 4

13. When confronted with ongoing troublesome circumstances I often start "brooding" and find it difficult to stop. 1 2 3 4

14. I can make a volitional (free) decision to keep on top of things and remain confident even when I have to face some troublesome events. 1 2 3 4

15. When a problem appears to be insurmountable I know that it's just a matter of breaking it down into smaller problems. 1 2 3 4

16. I tend to think that my worrying thoughts might reflect the reality. 1 2 3 4

17. When I experience taxing demands I try to act as in the motto "There are no problems, only solutions". 1 2 3 4

18. If I were overwhelmed by a big task I would stop and take smaller steps. 1 2 3 4

Appendix 13: Metacognitions Questionnaire 30 (MCQ-30)

This questionnaire is concerned with beliefs people have about their thinking. Listed below are a number of beliefs people have expressed. Please read each item and indicate how much you generally agree with it. Please respond thinking of **your general experience and behaviour** across situations and times. By referring to the scale for each item, select the number that corresponds to your choice:

1 Do not agree

2 Agree slightly

3 Agree moderately

4 Agree very much

1. Worrying helps me to avoid problems in the future	1	2	3	4
2. My worrying is dangerous for me	1	2	3	4
3. I think a lot about my thoughts	1	2	3	4
4. I could make myself sick with worrying	1	2	3	4
5. I am aware of the way my mind works when I am thinking through a problem	1	2	3	4
6. If I did not control a worrying thought, and then it happened, it would be my fault	1	2	3	4
7. I need to worry in order to remain organised	1	2	3	4
8. I have little confidence in my memory for words and names	1	2	3	4
9. My worrying thoughts persist, no matter how I try to stop them	1	2	3	4
10. Worrying helps me to get things sorted out in my mind	1	2	3	4
11. I cannot ignore my worrying thoughts	1	2	3	4
12. I monitor my thoughts	1	2	3	4
13. I should be in control of my thoughts all the time	1	2	3	4
14. My memory can mislead me at times	1	2	3	4

15. My worrying could make me go mad   1   2   3   4

16. I am constantly aware of my thinking   1   2   3   4

17. I have a poor memory   1   2   3   4

18. I pay close attention to the way my mind works   1   2   3   4

19. Worrying helps me cope   1   2   3   4

20. Not being able to control my thoughts is a sign of weakness   1   2   3   4

21. When I start worrying, I cannot stop   1   2   3   4

22. I will be punished for not controlling certain thoughts   1   2   3   4

23. Worrying helps me to solve problems   1   2   3   4

24. I have little confidence in my memory for places   1   2   3   4

25. It is bad to think certain thoughts   1   2   3   4

26. I do not trust my memory   1   2   3   4

27. If I could not control my thoughts, I would not be able to function   1   2   3   4

28. I need to worry, in order to work well   1   2   3   4

29. I have little confidence in my memory for actions   1   2   3   4

30. I constantly examine my thoughts   1   2   3   4

Appendix 14: Template for a debrief letter (manor adjustments were made for each study)

Thank you very much for taking part in this study, your contribution is greatly appreciated

All data gathered during this study will be held securely and confidentially. If you wish to withdraw, please contact the researcher via the e-mail uniexperience@londonmet.ac.uk and your data will be removed from the data set. Please note that you can withdraw only up to a point when all responses are anaonumised. After that it is impossible to identify your responses from those of other participants and your data will be impossible to remove.

The aim of this study was to identify what psychological predictors contribute to students learning progress or lack of it. In simple words, this study looked at what variables predict students' grades and what was the relationship between those variables. Currently universities across the UK invest a vast amount of resources into improving students' learning in Higher Education. Most existing schemes are mainly concerned with the development of academic skills and competences and there is an absence of programmes that intervene on psychological determinants of learning. However, before such programmes can be designed, we need to understand what psychological determinants affect learning in Higher Education, and how they can be intervened on through developing and testing a model of academic performance.

The questionnaire you filled in (a) provided valuable information about the relationship between approaches to studying and emotions in studying and academic performance; or (b) helped to develop a new measure of creativity that is a short and concise measure of students' tendency to use creative thinking strategies in studying; or (c) provided valuable information about reliability and validity of new Use of Creative Cognition Scale; or (d) provided valuable information for helping understanding the relationship between students' tendency to use creative thinking strategies in studying and emotions in studying; or (e) provided valuable information about the relationships between psychological determinants of learning and academic performance.

The knowledge obtained from this research will allow designing an effective intervention aiming to improve students' learning and academic performance.

Should you have any distress or further questions about any aspect of your participation in this study, please raise it with the Project Investigator in the first instance or with the Project Supervisor.

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If you feel your distress or concerns are more serious or complex you may wish to contact the Student Counselling Service on the following telephone numbers:

City Campus Counselling service:
Student Serveces Centre
Calcutta House, Old Castle Street
London E1 7NT
☎ 020 7320 2370

North Campus Counselling service:
Student Services Centre
Tower Building, 116-220 Holloway Road
London N7 8DB
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