Development and validation of the short Use of Creative Cognition Scale in studying

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Running head: THE SHORT UCCS SCALE

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Abstract

This paper reports the development and validation of a short Use of Creative Cognition Scale in studying (UCCS) that was inspired by the Cognitive Processes Associated with Creativity (CPAC) scale. In Study 1, 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 2, 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.

Keywords: Creativity in Studying; Little c Creativity; Measurement of Creativity; Process Creativity; Scale Development; University Students.

INTRODUCTION

Ability for creativity is one of the three abilities that are argued to be important for success (along with analytical and practical abilities) because creativity enables individuals to imagine, synthesize, connect, invent and explore, particularly when they tackle challenging and ill-structured problems (Sternberg & Lubart, 1995). Since its conceptualization creativity took a special place in education, and has been considered a skill that will enable individuals to adapt in a constantly changing environment and develop their potential. However, despite over half a century of empirical research on creativity there are still basic disagreements on the definition of creativity (Davis, 2004) and ways to measure it (Runco & Pritzker, 2011). Multiple measures of creativity were developed and validated throughout the history of research on creativity, including self-reported questionnaires as well as tests and third party ratings that have in common issues with validity, reliability and practicality (Feldhusen & Ban Eng Goh, 1995; Miller, 2009).

As the concept of creativity developed, the "creative cognition approach" to studying creativity was proposed. This approach is related to the "little c" perspective on creativity as it argues that creativity is a universal human characteristic and a multidimensional construct that is dependent on multiple cognitive processes (Finke, Ward, & Smith, 1992). The creative cognition approach is concerned with studying the use of creative techniques and strategies of thinking that lead to being creative (Davis, 2004). Various cognitive processes associated with creativity have been identified, such as convergent and divergent thinking, metaphorical and analogical thinking, perspective taking, imagery and incubation (for a review see Davis, 2004).

Within the creative cognition approach creativity is argued to be best researched through the use of experiments (Ward, 2007). Although experiments allow looking in more detail at which cognitive processes facilitate creativity, the experimental approach is limiting

in its use to study relationships between creativity and other psychological constructs in real life contexts. Therefore, there is a need of developing self-reported measures that assess the cognitive processes associated with creativity in relevant contexts, particularly in the study domain.

Although there are many 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 to deploy their creative ability to studying, that is, the 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 in order to monitor students' use of creative cognition and evaluate interventions aimed at fostering the deployment of students' creative cognition to studying.

Two self-reported measures have been developed 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 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 components 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 of construct validity and reliability of its subscales, and hence can be regarded as work in progress. Therefore, there is an apparent need for a short and direct measure assessing specifically the use of cognitive

processes associated with creativity, or simply creative cognition, in studying. The CPAC scale has inspired the attempt of the present study.

The CPAC Scale

Miller's (2009) CPAC scale provides an adequate item selection pool to constitute a handy self-reported scale measuring 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 frequency of using idea manipulation techniques (e.g., “Joining together different elements can lead to new ideas”). The Idea Generation subscale measures 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 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 frequency of using techniques like visualization 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 beliefs about usefulness and 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 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 frequency of experience of a highly automatic, effortless state of complete absorption in the activity that is also characterized 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 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.

Goals and Plan of the Study

The present study developed and validated the short Use of Creative Cognition Scale in studying (UCCS) to measure university students' use of creative cognition in studying. Study 1 modified the original CPAC scale, explored its factor structure, and selected a subset of items to constitute the UCCS. Study 2 corroborated the factor structure of the UCCS on a different sample, and examined its concurrent validity in respect to conceptually related constructs and scales and its discriminant validity in respect to conceptually unrelated constructs and scales.

STUDY 1:

SCALE DEVELOPMENT AND EXPLORATION OF ITS FACTOR STRUCTURE

This study 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 conceptualized 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 cognition 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. Generally,

incubation is conceptualized as a stage of the creative process rather than a process of its own (Amabile, 1996; Wallas, 1926). Furthermore, the founding argument of the process models of creativity is that it is very important to consider the sequence of the creative process steps or stages, as failure to combine them adequately is unlikely to result in any creative thought (Lubart, 2001). Thus, studying the incubation stage of the process, rather than an overall process that involves incubation as one of its stages is limiting. 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. Moreover, there is no evidence that people can deliberately enter flow as much as they can, for example, deliberately engage in brainstorming. Finally, 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. The second aim of the study is to develop a short measure assessing 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.

Method

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 = 28.96; SD = 9.43) and 395 (76.4%) females with age range 18 to 62 (M = 25.01; SD = 7.21). Two participants withheld information about their gender. The age and gender composition of the sample is similar to that of samples of other studies that were conducted at the same university over the years (e.g., Moneta, Spada, & Rost, 2007; Moneta, Vulpe, & Rogaten, 2012; Rogaten, Moneta, & Spada, 2013), suggesting that the study sample is representative of the university's population.

The sample consisted of 244 (47.2%) UK nationals, 257 (49.7%) citizens of other countries, 8 (1.5%) holding dual citizenship of which one was from the UK, and 8 (1.5%) withheld information about their nationality. Ethnically participants were 274 (53%) White, 78 (15.1%) Black, 22 (4.3%) Indian, 9 (1.7%) Chinese, 4 (0.8%) Japanese, 40 (7.7%) of mixed ethnicity, 70 (13.5%) from other ethnic backgrounds, and 20 (3.9%) withheld information about their ethnic origin.

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, 60 (11.6%) from the Faculty of Social Science, 47 (9.1%) from the Faculty of Humanities, Art and Language, 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 program: 18 (3.5%) were foundation degree students, 211 (40.8%) were first year undergraduate students, 114 (22.1%) were second year undergraduate students, 77 (14.9%) were third year undergraduate students, 26 (5%) were

graduate conversion diploma students, 63 (12.2%) were postgraduate students, and 3 (0.6%) withheld that information.

Measures

Cognitive Processes Associated with Creativity Scale (CPAC). The CPAC scale is a 28-item self-reported questionnaire measuring cognitive processes associated with creativity on six subscales (Miller, 2009). This study used an adapted version of the questionnaire consisting of 21 self-reported items measuring creative cognition spanning on four subscales: Idea Manipulation, Imagery/Sensory Cognitive Strategy, Metaphorical/Analogical Thinking, and Idea Generation Cognitive Strategy. 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 contextualized 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 are 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 can 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, whereas the reliability of the four selected subscales ranged from .602 to .738 (Miller, 2009).

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 2010-2011. 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.

Results and Discussion

Exploration of the Factor Structure of the CPAC Scale

The scores of the 21 CPAC items were analyzed using principal axis factor analysis. The factor extraction 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 suggested that only one factor should be extracted. Parallel analysis conducted in ViSta-PARAN (Young, 2003) using the data matrix permutation method with 10,000 simulated samples, produced the following estimates of the upper 95th percentile for the first three eigenvalues: 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 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.

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, 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 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”) in the present study to emphasize actual behaviour over belief in line with the style of the other four 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 analyzed using principal axis factor analysis. One factor accounted for 48.05% of the variance. Table 1 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.

Insert Table 1 about here

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 frequency of use of creative cognition in studying.

STUDY 2:

CORROBORATION OF FACTOR STRUCTURE AND ASSESSMENT OF CONCURRENT AND DISCRIMINANT VALIDITY

The present study has two goals. The first goal is to further evaluate the construct validity and internal consistency of the UCCS, which was developed in Study 1, on a new student sample. The second goal is to evaluate the concurrent validity of the UCCS in relation with conceptually related constructs and scales and its discriminant validity.

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, and each definition led to the development of a specific scale of measurement (Moneta, 2012a). We will consider two such conceptualisations. In the original definition (Csikszentmihalyi, 1975) flow was characterized 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 characterized 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 subscale of flow showed to have positive relationships 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 cognitive processes associated with creativity, measures of the two constructs should converge. Therefore, it was hypothesised that both measures of flow would positively correlate with the UCCS.

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; so that, one identifies him/herself with the task's values and integrate 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 representing 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 et al., 1994). 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, it was hypothesised that trait intrinsic motivation would positively correlate with the UCCS, whereas no hypothesis was posited for trait extrinsic motivation.

Use of Creative Cognition and Affect

Affect signifies individual's feelings and moods and can be positive or negative (Russell & Carroll, 1999). Positive affect comprises positive emotions like love, interest and joy (Fredrickson, 1998) that were found to broaden attention (Derryberry & Tucker, 1994; Rowe, Hirsh, & Anderson, 2007), enhance working memory (Ashby, Isen, & Turken, 1999; Ashby, Valentin, & Turken, 2002), facilitate decision making (Isen, 1987, 2001) and improve problem solving (Ashby et al., 1999; Isen, 1987). Negative affect comprises negative emotions like feeling afraid, upset and hostile (Fredrickson, 1998) that were found to reduce overall cognitive performance (Christodoulou et al., 2009; Gasper & Clore, 2002).

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, Daubman, & Nowicki, 1987; Vosburg, 1998). Evidence from longitudinal studies on workers suggests that positive affect causes 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, 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", "person" and "press" creativity, whereas it should hinder "process" creativity by virtue of

narrowing the scope of attention. Therefore, it was hypothesised that positive affect would positively correlate, whereas negative affect would negatively correlate, with the UCCS.

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 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: Confidence in Extinguishing Perseverative Thoughts and Emotions (which frees up cognitive resources for more effective functioning), 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 the mind up for problem solving), and 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 cognitive processes potentially leading to creativity. Therefore, it was hypothesised that all three adaptive metacognitive traits would positively correlate with the UCCS.

From a clinical psychology perspective, maladaptive metacognitions are theorised to foster excessive threat monitoring, perseverative thinking, and maladaptive coping in response to external stimuli and to one's own internal states, and to maintain psychological dysfunction through these processes (Wells & Matthews, 1994; Wells, 2000). 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 predict maladaptive learning processes such as surface approach to studying and avoidance coping in studying, and not to predict 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, maladaptive metacognitive traits are from uncorrelated to weakly and negatively correlated with the other two adaptive metacognitive traits. In all, these findings indicate that maladaptive metacognitive traits should be relatively independent of the

use of creative cognition in studying. Therefore, the analysis of the correlations between the UCCS and maladaptive metacognitive traits will provide a means to assess the discriminant validity of the scale.

Method

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 =25.93; SD = 7.95) and 500 (71.8%) females with age range 18 to 63 (M =24.92; SD =7.78); four males and two females withheld the information about their age. The age and gender composition of the sample is similar to that of the sample of Study 1.

The sample consisted of 346 (49.7%) UK nationals, 321 (46.1%) citizens of other countries, 19 (2.7%) holding dual citizenship of which one was from the UK, and 10 (1.4%) withheld the information about their nationality. Ethnically, participants were 340 (48.9%) White, 106 (15.2%) Black, 49 (7%) Indian, 13 (1.9%) Chinese, 2 (0.3%) Japanese, 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%) from the Business School, 40 (5.7%) from the Faculty of Law and International Relations, 60 (8.6%) from the Faculty of Social Science, 95 (13.6%) from the Faculty of Humanities, Art and Language, 2 (0.3%) from other faculties, and 8 (1.1%) withheld the information about their subject area. Students were also from different years of their degree program: 96 (13.8%) were foundation degree students, 260 (37.4%) were first year undergraduate students, 98 (14.1%) were second year undergraduate students, 96 (13.8%) were third year undergraduate students, 49 (7%) were graduate conversion

diploma students, 88 (12.6%) were postgraduate students, 1 (0.1%) was a PhD student, and 8 (1.1%) reported to be from another level of their university program.

Measures

Use of Creative Cognition Scale in studying (UCCS). This is the 5-item questionnaire that was developed in Study 1. As in study 1, 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".

Short Dispositional Flow Scale-2 (SDFS-2; Jackson, Martin, & Eklund, 2008). The SDFS-2 consists of 9 items, each measuring one of the nine dimensions of flow described in the introduction. 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 measures 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 has 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 and general self-concept, and a negative correlation with anxiety (Jackson, Martin, & Eklund, 2008).

Short Flow in Work Scale (SFWS; Moneta, 2012b). The SFWS consists of 3 items, each measuring one of the original components of flow described in the introduction in the context of work. 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 measures 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 has satisfactory internal consistency of .80, correlates with the SDFS-2 flow scale, and has 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). The WPI consists of 30 items, of which 15 measure trait extrinsic motivation and its subscales of compensation and outward and 15 measure trait intrinsic motivation and its subscales of challenge and enjoyment. 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 measures 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 has satisfactory internal consistency of .70 for extrinsic motivation and .75 for intrinsic motivation, and has good concurrent validity through positive correlations with measures of personal development, autonomy, ability utilization and achievement (Loo, 2001).

Positive and Negative Affect Schedule (PANAS) – Short Form (I-PANAS-SF; Thompson, 2007). The I-PANAS-SF is a list of ten adjectives, five measuring positive affect (e.g., "attentive") and five measuring negative affect (e.g., "nervous"). The instructions for filling in the questionnaire were: "Please read the following adjectives in detail and think if you have those feelings. Please respond thinking of your current experience when you engage in

study activities. Please choose the response that best describes the intensity of those feelings". Thus, the questionnaire measures domain-specific state affect. Adjectives were scored on a 5-point scale ranging from 1 (*None*) to 5 (*Very Much*). The scores for positive affect and negative affect were calculated by averaging the scores of their constituent items. The scale has good internal consistency of .80 for positive affect and .74 for negative affect, has good concurrent validity through positive correlations of positive affect, and negative correlations of negative affect, with measures of happiness and subjective well-being (Thompson, 2007).

Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ; Beer & Moneta, 2010). The PMCEQ consists of 18 items measuring the three adaptive metacognitive traits described in the introduction, each using 6 dedicated items. 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 measures adaptive metacognitions as uncontextualized 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 have 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). The MCQ-30 consists of 30 items measuring the five maladaptive metacognitive traits described in the introduction, each using 6 dedicated items. 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 measures maladaptive metacognitions as uncontextualized 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 have good internal consistency in the range .72 to .93, and good convergent validity through positive correlations with obsessive-compulsive symptoms, worry, and trait anxiety (Wells & Cartwright-Hatton, 2004).

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 2011-2012. 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.

Results and Discussion

Assessment of Construct Validity

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 chi-square test of the confirmatory factor model was significant (chi-square = 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 cut-off point indicating good fit, the Standardized Root Mean Square Residual (SRMR = .038) was less then the cut-off point of .05 indicating good fit, whereas the Root Mean Square Error of Approximation (RMSEA = .78) was greater then the close-fit cut-off point of .05 indicating only acceptable fit. Figure 1 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 Study 1 using exploratory factor analysis. In all, the findings corroborate the unidimensional factor structure of the scale.

Insert Figure 1 about here

Assessment of Concurrent and Discriminant Validity

Table 2 shows the descriptive statistics and intercorrelations of the scores of the UCCS and conceptually related and unrelated scales. The internal consistency of the UCCS was good and virtually identical to the estimate of Study 1. All other measures had from satisfactory to good internal consistency, with the exception of trait extrinsic motivation, which fell below the threshold of .7 for acceptable internal consistency.

Insert Table 2 about here

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, indicating that use of creative cognition in studying as measured by the UCCS is a distinct construct within its nomological network. Finally, 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.

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. 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.

GENERAL DISCUSSION

The present study reported the development and validation of the Use of Creative Cognition Scale in studying (UCCS), a handy scale designed to measure university students' use of creative cognition while engaged in study activities. Study 1 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 that the proposed four-factor structure did not hold, and 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 2 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. Moreover, the scale had good internal consistency, almost identical to that estimated in Study 1. Finally, the scale displayed good concurrent validity through correlations with measures of related constructs, and acceptable discriminant validity through absence of relationships with measure 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, 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, which go in line with a large body of empirical research showing that positive affect enhances cognitive

performance (Ashby et al., 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).

We also explored for the first time the relationships between use of creative cognition and adaptive metacognitive traits (Beer & Moneta, 2010). 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, and 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 accomplishment of the task at hand facilitate 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 predict maladaptive learning processes and not to predict adaptive learning processes. The UCCS showed no relationship with three core maladaptive metacognitive traits, which substantially supports the discriminant validity of the scale, but had weak and positive correlations with Cognitive Self-Consciousness and Need to Control Thoughts. These associations are not necessarily evidence of 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, and 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", and hence 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.

This study has 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 2 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. Third, the UCCS does not measure the incubation process that is suggested to be important in "process" creativity. The originally proposed CPAC items for measuring incubation were not assessing it adequately, arguably because incubation can only be understood as a specific stage in a multi-stage creative process (Amabile, 1996; Wallas, 1926). Future research should try to measure incubation as a stage connected to other stages, develop a subscale that would measure incubation for the CPAC scale, and identify one or two items that could be added to the UCCS. Finally, this study assessed the use of creative cognition during study activities and in two student samples that predominantly consisted of females; so that, the findings do not generalize to other contexts of activity, other student populations 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 and study populations of interest.

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 UCCS is a useful tool particularly for a frequent monitoring of change, using for example end-of-day diaries or experience sampling methods, in both longitudinal studies involving no intervention and in intervention programs designed to enhance students' creativity.

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Table 1

Means, standard deviations, and factor loadings of the UCCS items (Study 1).

Item	*X*	*SD*	Loading
1. I find effective solutions by combining multiple ideas	3.63	.89	.763
2. While working on something, I try to generate as many ideas as possible	3.76	.96	.725
3. I try to act out potential solutions to explore their effectiveness	3.40	.94	.665
4. If I get stuck on a problem, I try to take a different perspective of the situation	3.67	.92	.664
5. Incorporating previous solutions in new ways leads to good ideas	3.67	.84	.639

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

Table 2

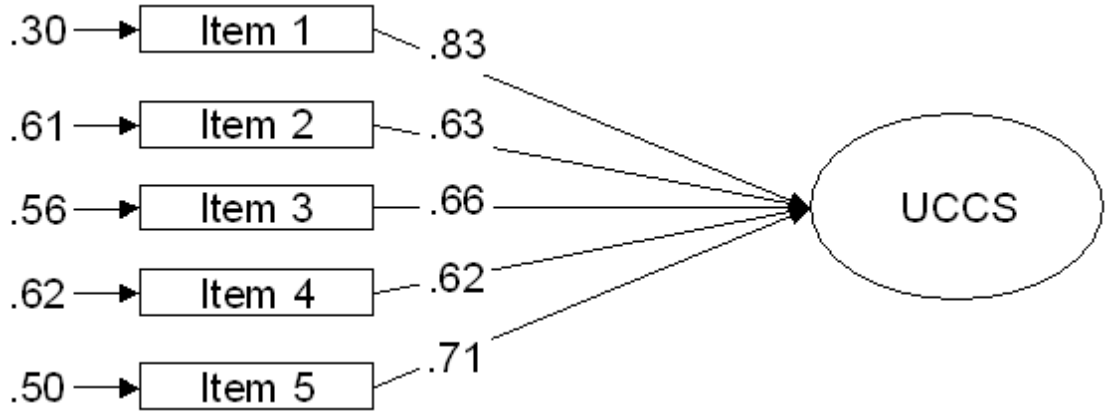
Means, standard deviations, Cronbach's alpha (in parentheses) and correlation coefficients of the study variables (Study 2).

Variable	*X*	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. UCCS[a]	3.74	.69	(.82)														
2. SDFS-2[a]	3.58	.57	.531**	(.75)													
3. SFWS[b]	2.47	.75	.364**	.448**	(.82)												
4. WPI-IM[b]	2.89	.44	.540**	.540**	.547**	(.80)											
5. WPI-EM[b]	2.66	.39	.199**	.172**	.229**	.167**	(.66)										
6. I-PANAS-SF-PA[a]	3.71	.70	.463**	.461**	.264**	.342**	.153**	(.76)									
7. I-PANAS-SF-NA[a]	2.01	.81	-.105**	-.243**	.008	-.102**	.125**	-.164**	(.79)								
8. PMCEQ-1[b]	2.68	.74	.076*	.139**	-.068	.055	-.211**	.163**	-.403**	(.85)							
9. PMCEQ-2[b]	2.51	.62	.356**	.335**	.282**	.367**	-.014	.268**	-.171**	.190**	(.75)						
10. PMCEQ-3[b]	2.75	.65	.438**	.415**	.277**	.382**	.132**	.380**	-.258**	.162**	.683**	(.82)					
11. MCQ-30-1[b]	2.02	.75	.049	.001	.15**	.025	.208**	.058	.191**	-.359**	.088*	.095*	(.89)				
12. MCQ-30-2[b]	2.21	.82	-.014	-.106**	.111**	-.027	.192**	-.061	.405**	-.680**	-.158**	-.136**	.344**	(.86)			
13. MCQ-30-3[b]	1.91	.72	-.007	-.157**	.084*	-.039	.104**	-.125**	.301**	-.446**	-.052	-.099**	.286**	.462**	(.85)		
14. MCQ-30-4[b]	2.13	.69	.103**	.052	.158**	.075*	.277**	.035	.264**	-.447**	.154**	.091*	.328**	.488**	.348**	(.76)	
15. MCQ-30-5[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. I-PANAS-SF-PA = Positive Affect; 7. I-PANAS-SF-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-30-1 = Positive Beliefs about Worry; 12. MCQ-30-2 = Negative Beliefs about Thoughts Concerning Uncontrollability and Danger; 13. MCQ-30-3 = Cognitive Confidence (lack of); 14. MCQ-30-4 = Beliefs about the Need to Control Thoughts; 15. MCQ-30-5 = Cognitive Self-Consciousness.
* $p < .05$ (1-tailed), ** $p < .01$ (1-tailed).

Figure 1

Standardized factor loadings and measurement errors of the UCCS items estimated using confirmatory factor analysis (CFA) on the data from Study 2.



Note. n = 696.