

Minority and Creativity: Identifying Age, Gender, and Personality Difference in Creative Problem-Solving Ability Among Minority Individuals

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Abstract

Ability to "think outside the box" required to restructure the problem by stepping out of the current activated cognitive schemas which is different among individuals. This difference were less paid attention among minority groups. This study examined the association between Big Five personality traits and a creative problem-solving task, Duncker candle problem, among a sample of international students. Results show; (1) gender and age were not significantly associated with the creative solution; (2) a high degree of Openness to Experience and Neuroticism linked with solving the problem among both male and female students, and (3) Extraversion and Agreeableness are shown to be differently associated with both gender's ability to solve the problem. Overall, implications of these results in academic environment were discussed.

Keywords: Minority, problem solving, big five personality traits, gender, and age

The cognitive processing engaged to manage and understand solutions of analytical problems is termed as “problem solving” (Pink, 2009). The difference between insight and incremental, non-insight problem solving, is the difference between cognitive processing involved during analytical problem solving (Friedman & Förster, 2005; Weisberg, 1995). The condition under which the task at hand is stated a specified objective of the problems or the solutions to be reached are referred to as an analytical task. Thus, what leads problem solving strategies ‘incremental’ in a task is that the objective is reached in a stepwise or algorithmic manner. Gradual increase in solving the problem follows through an incremental pattern in cognitive process (Davidson, 1995; Fleck, 2008; Friedman & Förster, 2005). In contrast, insight problem solving is reached through restructuring of the problem state or an underlying change in the structure of the elements of the problem (Bowden, Jung-Beeman, Fleck, & Kounios, 2005; Pink, 2009). During the problem solving process, the progression is, hence, not incremental, but engage a sudden insightful discovery of a goal stated, a phenomenon generally are known as the “aha” experience (Karimi, Windmann, Güntürkün, & Abraham, 2007; Thagard & Stewart, 2011; Topolinski & Reber, 2010).

During the insight problem solving process, the underlying struggle that individual encounters is to step out of the cognitive schemas in progress and approach the solution from a completely innovative way (Karimi et al., 2007; Pink, 2009). According to Schooler, Fallshore, and Fiore (1994) a main series of influential factors is engaged to an incapability to overcome impasses in attaining insights in solving process (e.g. an excessive focus of irrelevant indications) and in catalogued strategies that help to restructure the situation in insight process (e.g. varying the context). In fact, creative problem solving required three abilities including; first, the executive functioning to choose strategies; second, working memory to grip the component of the problem in mind; and finally, processing speed to achieve the answer while the elements hold in mind (Pink, 2009). These three abilities tend to decline by increasing the age among adults (Hassing & Johansson, 2005). For example, research findings demonstrated that slower processing speed and fewer strategies using in solving complex math problems in experiments with older adults (Lemaire & Arnaud, 2008). However, no significant gender effects were reported by many studies. D’Zurilla, Maydeu-Olivares, and Kant (1998) found no difference between male and female in social problem solving among a large sample of individuals aged from 17 to 80. Similarly, Baer and Kaufman (2008) in a meta-analysis study reported no gender difference in creative tasks.

Eysenck (1995), however, suggested problem solvers are characterized by a wider associational style of thinking that provide access to more broadly associated concepts than usual because of their broad conception of relevance. Consequently, such individuals create more novel and inaccessible ideas. Eysenck's thoughts were supported in findings where highly creative individuals have a high degree of psychoticism and neuroticism personality traits (Eysenck, 1992; Eysenck & Eysenck, 1976).

To attain a better understanding of the links between personality and creativity, a meta-analysis of personality traits associated with scientific and artistic creativity using data from 83 studies conducted by Feist (1998) demonstrated that more creative scientists scored less on conscientiousness and agreeableness. This shows agreeableness and conscientiousness negatively correlated with creative solution. In addition, Feist described Neuroticism as a tendency to experience dysphoric affect, especially, sadness, hopelessness and guilt (McCrae & Costa, 2008) and concluded that higher levels of anxiety, vulnerability, and emotional sensitivity usually leads to higher levels of creativity (Grosul, 2010).

McCrae (1987) proposed that individuals with a highly creative ability have a wide associational or inclusive cognitive style of thinking that enable them to be more broadly associated with new concepts and structures. These individuals are able to generate more new and inaccessible ideas. McCrae and Costa (2008) noted that exposure to new experiences is closely associated with a flexible cognitive style of thinking during problem solving process that is being able to "think outside the box" and not being closed to anyone's view (functional fixedness). In addition, they wrote openness and flexibility are associated with cognitive ability that contemplates how things could be, not just how they are (McCrae, 1987). Therefore, open individuals has a broad thoughts, feelings, and problem-solving strategies by being exposure to a variety of contradictory perspectives, ideas, people, and situations. The combinations of these showed to generate innovative and unusual solutions (Leung & Chiu, 2008). McCrae's notions have been supported by findings in which the inclination of openness to experience entails first and foremost a response style to novel ideas, people, or situations (Batey & Furnham, 2006; Batey, Furnham, & Safiullina, 2010; Feist, 1998; George & Zhou, 2001; Leung & Chiu, 2008, 2010; Simonton, 2000).

Another aspect of Big Five personality traits, Extraversion, were found to be inconsistent in association with creativity over the literature. For example, a positive relationship has been reported between extraversion and creativity test performance (Furnham & Bachtiar, 2008). The study by Mangan (1978) and Leith (1972) found no significant linear

relationships between extraversion and creativity measures. In contrast, Kumar (1978) empirically found superior creativity performance among introverted individuals.

However, the association between individuals' difference and problem solving notes to be more complex among the minority groups. For instance, Simonton (2000) wrote that although studies on creativity and personalities have constantly sought to show that a number of personality aspects in association with creativity, psychologists still have a long way to go before they come anywhere close to understanding creativity in women and minorities (see, e.g. Helson, 1990; Kenworthy, Hewstone, Levine, Martin, & Willis, 2008; Nicholls, 2011). Thus, understanding of individual difference of minority group including personality traits, age, and gender has yet remained unclear (Simonton, 2000). Therefore, in this way of mind, the current study was established to look into association between individual difference and a creative problem solving among a sample of international students as a minority group in a host country.

Method

Data were collected using a convincing sampling method from international students at the main library at Universiti Putra Malaysia (UPM). A set of questionnaires was designed to measure Big Five Aspects of Personality, Problem Solving Ability, and demographic profile (e.g. age, gender, nationality, education levels, etc.). A statement also asked of time when individuals spent in host country as it was shown to be indicators of creativity (Maddux & Galinsky, 2009). Study instructions and instruments were in English.

Participants

A total of 156 full-time students were completed the questionnaires. Participants' average age was 29.59 years (SD = 6.88, from 18 to 49). Approximately, 25% of students were pursuing their degree, and the rest, 75%, was postgraduate students. The study sample comprised around 65% male and 34% female. Students came from 25 different nationalities including Nigeria (40), Iraq (26), Indonesia (15), Iran (9), Yemen (6), Palestine (14), China (6), Pakistan (6), Labia (4), Uganda (2), India (4), Myanmar (2), Saudi Arabia (2), Thailand (2), Jordan (2), Sri Lanka (2), Gambia (2), Congo (1), Gambian (1), Cameron (1), Maldives (1), Zimbabwe (1), Singapore (1), Gabon (1), Sudan (1), Somalia (2).

Instruments

Duncker Candle problem was used to assess the problem solving capabilities (e.g., Pink, 2009; Gino & Ariely, 2012; Maddux, Adam, & Galinsky, 2010; Maddux & Galinsky, 2009). It comprises a book of matches, a small cardboard box full of tacks, and a candle placed on a table. Participants of the study were presented to find a way to attach the candle properly to the wall so that the candle can burn properly and not drip wax onto the table. The solution was asked to be painted or written. Participants' solutions were dichotomously scored by wrong and correct answer; to be considered correct, responses had to include the use of the box of tacks as a candleholder. The solution is considered as a measure of insight creativity because it involves the ability to see objects as performing different functions from what is typical (i.e., the box is not just a repository for tacks but can also be used as a stand). In other words, there is a hidden solution to the problem that is inconsistent with preexisting associations and expectations (Duncker, 1945; Glucksberg & Weisberg, 1966).

Personality Traits were assessed using the 100-item Big Five Aspects Scale (BFAS; DeYoung, Quilty, & Peterson, 2007). Items were rated on a 5-point scale ranging from 0 (Never or rarely true) to 4 (Very often true or always true) reflecting mid-level personality traits, situated between the five broad domains and the narrower aspect level of personality. Either of domains of the BFAS breaks down into two of these mid-level aspects in an equal number of items, 20 items, including assertiveness and enthusiasm (extraversion), compassion and politeness (agreeableness), industriousness and orderliness (conscientiousness), volatility and withdrawal (neuroticism), and openness and intellect (openness/intellect). The BFAS thus provides a measure with the wide Big Five domains, and the additional advantage of testing empirically-derived mid-level personality traits. Although the traits from each aspect are correlated with each other, they also manifested divergent validity. All items were validated as indicators for the 10 mid-level Big Five domains. As a measure of the wide aspects, the BFAS has validated against standard Big Five instruments such as the BFI (John & Srivastava, 1999) and the NEO PI-R (Costa & McCrae, 1992b) with an average uncorrected correlation of $r = .76$. The scale also shows internal (mean $r = .83$) and test-rest (mean $r = .81$) reliability.

Control Variables. Time spent living in the host country were controlled since it was shown to associate with creativity and problem solving ability (Maddux & Galinsky, 2009).

Results

The mean, standard deviation, skewness, kurtosis, and reliability of Big Five Aspects of Personality are shown in Table 1. Each of these variables had an acceptable alpha reliability and approximately normal distribution. Students showed they have been living in Malaysia from 1 month to 96 months ($M = 23.89$, monthly, $SD = 18.37$). The mean of 27.13 for Neuroticism indicates that on the average students were reported significantly less than the scale midpoint. However, the Openness to Experience mean of 50.13, significantly above the scale midpoint, suggested that students are highly open to experience. On the average, students indicate a high agreeableness, consciousness and extraversion. Overall, 31% participants solved the problem correctly.

Table 1
Descriptive Analysis and Reliability of Personality Scale

	Mean	St. Deviation	No. Items	Alpha	Skewness	Range
Neuroticism	27.12	7.56	20	.78	-.291	12-42
Agreeableness	51.22	9.46	20	.73	-.177	22-76
Consciousness	49.95	9.28	20	.77	.546	33-73
Extraversion	48.02	8.437	20	.76	.094	33-68
Openness	50.13	8.496	20	.74	.426	34-69

Gender differences in creative solution were assessed using Chi-square test. The results of 2×2 cross tabulation demonstrated that there is no significant difference between males and females in problem solving ability [$\chi^2 = 1.93$, $p = 0.16$]. However, since the problem solving ability were a dichotomous, a hierarchical, binary logistic regression was conducted testing the association between age, gender, Big Five Aspects of personality and the problem solution. Insignificant chi-square test showed a goodness of model fit [χ^2 (DF=7) = 13.35, $p = .064$]. The results of step1 illustrated that increase in age did not predict the creative solution. However, after controlling effect of age, gender, nationality, months in Malaysia and educational levels ($R^2 = .20$), the step 2 (Table 2) indicated that age negatively predict the creative solution ($B = -.16$, $p = .03$). Among Big Five personality traits, Openness and Neuroticism were the predictors of creative solution ($B = .24$, $p = .002$, $B = .12$, $p = .03$; respectively, $R^2 = .51$).

Table 2
Individuals' Difference as the Predictors of Creative Solution (Step 2)

	B	S.E.	Wald	Sig.	R^2
Gender(Male = 1)	-.74	.71	1.08	.30	.53
Age	-.18	.09	4.23	.04	
Nationality	.04	.06	.43	.51	

Educational Level	1.22	.73	2.78	.09
Years in Malaysia	-.02	.02	1.28	.26
Neuroticism	.15	.07	4.47	.03
Agreeableness	.09	.05	2.83	.09
Consciousness	-.03	.06	.30	.58
Extraversion	.02	.05	.15	.69
Openness	.24	.07	9.99	.00
Constant	-16.177	5.964	7.357	.007

Educational Level (1= Bachelor, 2= Master, 3= PhD)
Nationality (1= Chinese to 25= Tanzanian)

Furthermore, splitting the data by gender revealed that the effect of Openness was apparent for both males and females (Table 3). However, Extraversion was shown a significantly negative predictor of the creative solution for females (B= -.33) and positive for male students (B= .37). Although insignificant, this difference patterns was repeated for Agreeableness, Extraversion and age among female and male students (for review look at Table 3). Increase in age and higher levels of introversion and consciousness was positively predicted problem solving ability for females. These results indicate the importance of individuals' difference between males and female students separately in creative problem solving.

Table 3
Spiting Data by Gender; Prediction of Creative Solution

	Female (n=57)					Male (n=99)				
	B	S.E	Wald	Sig.	R ²	B	S.E	Wald	Sig.	R ²
Age	.41	.21	3.66	.05	.42	-.16	.09	3.07	.07	.74
Neuroticism	.03	.15	.04	.84		.01	.09	.01	.96	
Agreeableness	-.12	.10	1.36	.24		.15	.10	2.19	.13	
Consciousness	.29	.18	2.63	.10		-.22	.13	2.59	.10	
Extraversion	-.33	.16	4.37	.03		.37	.17	4.62	.03	
Openness	.23	.12	3.28	.07		.26	.13	4.20	.04	
Constant	-16.46	13.06	1.58	.20		-22.94	9.82	5.45	.02	

Discussion and Conclusion

The discussion of the findings from the current research will focus on the nature of individual differences, personality traits, age and gender, in association with the problem solving task, Duncker candle problem. Using a quantitative method on sample of international students, a minority group, the primary results shows no gender difference in solving the task. Therefore, the current study provides support for affectlessness of gender role in solving the creative problem (Baer & Kaufman, 2008; D'Zurilla et al., 1998). However, the increase in age negatively, but insignificantly, indicated the decline in problem solving ability. According

to Hassing and Johansson (2005), function of mind to find new strategies in speed and memory regarding problem solving will gradually decline during lifetime (Lemaire & Arnaud, 2008). In contrast, further finding of splitting data by gender shows that female students positively associated with the creative solution. This may be due to the independence women gained in older aged (Crosson & Robertson-Tchabo, 1983; Güçlütürk, Jacobs, & van Lier, 2016).

The primary results of Big Five of Personality traits, however, were in line with pervious study (Feist, 1998; McCrae, 1987; Simonton, 2000). Students with high levels of Openness demonstrated the robust association with the creative problem-solving task. Open individuals are those who are appreciative of novel ideas and new experiences, receptive to a variety of perspectives and thoughts, and unafraid of recruiting unconventional ways to deal with a wide range of thoughts, feelings, and problem-solving strategies, the combination of which may lead to novel and useful solutions or ideas (Costa & McCrae, 1992a; Feist, 1998; McCrae & Costa, 1997). Not only do open individuals incline to learn from new cultural experiences and to turn into creative beings, but also open individuals will benefit from multicultural learning, living abroad experience, once they have the opportunities of learning in diverse contexts. Hence, it indicates that among individuals who are open to experience, the extent of multicultural experiences would be positively associated with the level of creative potential (Leung & Chiu, 2008). In addition, following the tradition of Eysenck and Eysenck (1976), and the study conducted by Xu and Brucks (2011), Neuroticism was positively predicted the creative solution. Neurotic individuals are referred to have the tendency to experience negative feelings such as anxiety, self-consciousness, mood swings and anger (McCrae & Costa, 2008). Consistent with pervious study reported that higher levels of anxiety, vulnerability, and emotional sensitivity usually lead to higher levels of creativity (Feist, 1998; Grosul, 2010). Overall, the findings confirmed by the data splitting among both male and female participants.

Nonetheless, Extraversion and Agreeableness was insignificant but positively correlated with the problem solution. The reason behind this positive result of Agreeableness can be justified with the sample of study, international students; showing higher Agreeableness may be as result of adaptation process in which the students are trying to show conformity with the new cultural environment in terms of better adjustment. Thus, among them, Agreeableness means familiarity with new ideas from the host culture which are shown to be strongly associated with creative problem solving ability (for review, see, Kirton, 2003;

Leung, Maddux, Galinsky, & Chiu, 2008). Furthermore, in line with traditional theory of Kirton's adaption-innovation theory (Kirton, 1976, 2003), showing the better individuals enable to adapt to a new culture, the more they enhanced their creative potential of problem solving, results demonstrated that the better individuals adapt to new cultural environment, higher Extraversion and Agreeableness, the more they cognitively enhance and, as a result, they shows positive correlation with creative performance. However, spitting data by gender showed inconsistency between male and female in these two aspects of personality traits. This observation was made by Simmon (2000), who delineated that difficult interpretation of these results. Therefore, Simmon (2000) himself pointed out that research should continue to understand the creativity in women and minorities (see, Helson, 1990).

However, the current study attempt was to understand the association between personality differences and creative problem solving performance underlying cognitive processes in general that ultimately is an important contribution to the development of better theories of creativity among individuals in foreign cultures. Furthermore, ability to "think outside the box" and generates creative way of thinking is craved by universities and institutions. Thus, future research with more diverse and varied methodologies should continue to explore the variables associated with problem solving ability. Future studies on larger and more representative samples concentrating on each gender would be necessary to establish the generality of the findings for minority group's individual differences. In sum, it can be concluded that a learning environment where affords and promotes Openness to Experience would be most conducive to promote students' creative potential.

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