Intelligence, Creativity and Gender as Predictors of Academic Achievement among Undergraduate Students

Habibollah Naderi[1], Rohani Abdullah[2], Tengku Aizan Hamid[3], Jamaluddin Sharir[4]

1. Department of Educational Studies, University of Mazandaran, Street of Pasdaran, Babolsar, Iran

2. Department of Human Development & Family Studies, University Putra Malaysia, Serdang 43400, Malaysia

3. Institute of Gerontology, University Putra Malaysia, Serdang, 43300, Malaysia

4. Department of Educational Psychology and Counselling, University of Malaya, 50603 Kuala Lumpur, Malaysia
naderihabibollah@yahoo.com

Abstract: In this cross – sectional study our purpose was to assess prediction of intelligence, creativity and gender on academic achievement among undergraduate students. Participants (N= 153, 105 = male & 48= female) completed intelligence and creativity tests and the cumulative grade point average (CGPA). A multiple regression analysis revealed an interesting pattern of significant relationship. Further, multiple regression analyses indicated that intelligence, creativity and gender explained 0.045 of the variance in academic achievement, which is not significant, as indicated by the F- values 2.334 . Multiple regression analyses also indicated that intelligence and creativity (gender is controlled) together explained 0.010 of the variance in academic achievement, which is not significant, as indicated by the F- values 1.562. Partial correlations between academic achievement and IQ, creativity scores and gender were non significant at .05. Coefficients also showed there is no significance between academic achievement and IQ and gender at .05, except for creativity (*t= 2.008, p= 0.046).* Finding shows predicting lower independent variables of this study (scores of intelligence and creativity and gender) on academic achievement (CGPA). [The Journal of American Science. 2009;5(2):45-56]. (ISSN: 1545-1003).

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1. Introduction

Academic achievement has been a topic of considerable interest and research for a very long time. Countless numbers of studies have been undertaken which either focused exclusively on academic achievement or investigated academic achievement in relation to other cognitive, social, and personal factors. Most of these studies have sought to determine factors that enhance academic achievement. The implications of these relationships for education are apparent since achievement in skill, concepts, and content are the acknowledged goals of the education process (A. K. Palaniappan, 2005 ,p-36).

Unlike creativity, which has been subjected to many different definitions, academic achievement or academic ability is relatively more easily defined, measured and interpreted (A. K. Palaniappan, 2005, p-36**).** A myriad of factors have been identified as being related to academic achievement. The three fundamental of which will be addressed in this study are: intelligence (Laidra, Pullmann, & Allik, 2007), creativity and gender ((A. K. Palaniappan, 2005),(Palaniappan, 2007a, 2007b)**.**

. This study asked if the more intelligent students become, the more creativity and more highly academic achievement will be gained. Therefore, the aim of this research is to answer the following questions: ‘’what are the relationships between intelligence, creativity and academic achievement?’’ ‘’what is the role of gender in filling the gap on academic achievement?’’. Consequently, in recent years many researches have been studies about affecting academic achievement and their correlation with other demographic and psychological factors(Aguirre Pérez, Otero Ojeda, Pliego Rivero, Ferreyra Martٍnez, & Manjarrez Dolores, 2008; Boykin et al., 2005; Caprara, Barbaranelli, Steca, & Malone, 2006; Contessa, Ciardiello, & Perlman, 2005; Finn, Gerber, & Boyd-Zaharias, 2005; Gooden, Nowlin, & Frank Brown and Richard, 2006; Hong & Ho, 2005; Jeanne Horst, Finney, & Barron, 2007; Johnson, McGue, & Iacono, 2006; Lipscomb, 2007; Magnuson, 2007; Martin, Montgomery, & Saphian, 2006; McNelis, Johnson, Huberty, & Austin, 2005; Noftle & Robins, 2007; O'Connor &

2. The Theoretical framework of this study

The theory applied for the present study is based on the theory of triarchic abilities (practical, creative and analytical) measured by Strenberg. Sternberg's Triarchic Theory is an important effort to synthesize the various theories of intelligence and creativity. This theory significantly contributes to the prediction of academic achievement, independent of general intelligence(Koke & Vernon, 2003). (R. J. Sternberg,et,.al., 1996) reported data indicating that the triarchic abilities are related to the scores on four tests of intelligence: the Concept Mastery Test, The Watson-Glaser Critical Thinking Appraisal, the Cattell Culture-Fair test of g, and a test of creative insight constructed by Sternberg and his colleagues. The highest correlations were found with the Cattell Culture-Fair test of g, which has been used extensively as a measure of general intelligence: the estimated correlations between the Cattell Culture-Fair test of general intelligence and the analytical, creative, and practical subtests of STAT, are 0.68, 0.78, and 0.51, respectively(Koke & Vernon, 2003).

3. Past Researches

In recent years, different researchers have shown the rising interest in the relationship between intelligence and academic achievement. Understanding the nature of the relationship between general cognitive ability and academic achievement has widespread implications for both practice and theory(Rohde & Thompson, 2007).

Watkins et al., (2007) stated that there has been considerable debate regarding the causal precedence of intelligence and academic achievement. Some researchers view intelligence and achievement as identical constructs. Others believe that the relationship between intelligence and achievement is reciprocal. Still others assert that intelligence is causally related to achievement. (Laidra et al., 2007) reported students' achievement relies most strongly on their cognitive abilities through all grade levels.

Laidra et al.,(2007) was studied as predictors of academic achievement in a large sample of 3618 students (1746 boys and 1872 girls) in Estonia. Intelligence as measured by the Raven's Standard Progressive Matrices was found to be the best predictor of students' grade point average (GPA) in all grades.(Deary, Strand, Smith, & Fernandes, 2007) have found correlation between intelligence and academic achievement. This study examined psychometric intelligence at the age of 11 years old and education achievement in 25 academic subjects at the age of 16. The correlation between a latent intelligence trait and a latent trait of educational achievement was 0.81. General intelligence contributed to success in all 25 academic subjects.

Aitken Harris, (2004) examined 404 adults of participants (203men and 201 women) completed four scales of a timed, group administered, intelligence test, 10 personality scales, and a creativity measures. Finding this study shows achievement have small to moderate positive correlations with an intelligence factor (which included the creativity scales).

Fodor & Carver, 2000) studied undergraduate students. Participants for the experiment were students of both sexes in engineering and science from Clarkson University, a predominantly technological university. Students completed the Thematic Apperception Test (TAT), which was scored for achievement motivation and also for Power motivation. They later participated in the experiment. There were 144 experimental participants, 48 in each of three experimental conditions: positive, negative, or no feedback concerning prior performance on an engineering problem. Achievement motivation correlated positively with creativity score in the positive and negative-feedback conditions (rs = .43 and .38) but not significantly in the no-feedback condition (r = .10). Power motivation correlated positively with creativity in the positive-feedback condition (r = .32), and negatively in the negative-feedback condition (r = −.25), but not significantly in the no-feedback condition (r = .17).

Finally some researchers have studied about gender differences.(Naderi.H., Abdullah. R & Tengku Aizan. H, 2008) reported there were no significance between males and females on intelligence but the result shows males' means are higher than females. However, Findings regarding gender differences in academic achievement are not unequivocal.

Deary et al., (2007)found there were sex differences in educational attainment. Girls performed better than boys on overall academic subjects (courses), with a Cohen's d of 0.30. There were significant sex differences ($p < 0.001$) in all academic subject (courses) scores except Physics. Girls performed better in every topic except in Physics. However, result shows the effect sizes of the sex differences were often substantial.

In contrast(Naderi, et. al, 2008) found there were no gender differences significant on creativity; however finding has shown the difference between males and females in subscales. According this result females scored higher than males in the initiative factor ($t = 3.566$, $p = .000$), and males scored higher than females in the environmental sensitivity factor ($t = -2.216$, $p = .028$). In the latter case(Birenbaum & Nasser, 2006) reported gender affect on achievement.

1.3 The present study

We hypothesized the relative-score between academic achievement, intelligence and creativity. The present study will provide a better estimate of the true association between academic achievement, intelligence and creativity by having fluid intelligence and creative perception inventory tests as predictors and cumulative grade point average, applied to undergraduate students. Another major issue addressed by the current study is the gender gap in academic achievement by the (CGPA).

. 1.4 Research hypotheses

a) There is positively predictor intelligence, creativity and gender on academic achievement among undergraduate students.
b) There is positively predictor intelligence, creativity on academic achievement among undergraduate students.

2. Method and Materials

2.1 Participants

One hundred and fifty three Iranian undergraduate students in Malaysian Universities (N= 48 (31.4%) females and N=103 (68.6%) males) were recruited as respondents in this study. Their ages ranged from 18 -27 years old for females (mean = 22.27, sd = 2.62) and 19-27 years old for males (mean = 23.28 and sd = 2.43).

2.2. Instruments

2.2.1 Catell Culture Fair Intelligence Test (CFIT-3a)

To evaluate the intelligence, every student was administered by a Scale 3 of the Catell Culture fair Intelligence Test (CFIT-3a). This is the well- Known test of fluid intelligence (Gf) developed by R.B.Cattell. (Roberto Colom, Botella, & Santacreu, 2002) has been reported that this test is a well-known test on fluid intelligence (GF) developed a Catell culture fair intelligence test. Participants completed Cattell's culture fair intelligence test battery to assess individual differences in fluid intelligence.

2.2.2 Khatena-Torrance Creative Perception Inventory (KTCPI)

Creative perception was examined using KTCPI (Khatena-Torrance Creative Perception Inventory) (A. K. Palaniappan, 2005). The Khatena-Torrance Creative Perception Inventory is based upon the rationale that creative functioning is reflected in the personality characteristics of the individual, in the way they thinks or the kind of thinking strategies they employs, and in the products that emerge as a result of their creative strivings. The scale presents statements to which subjects are required to respond. The responses reflect the extent to which the subjects function in creative ways (A. K. Palaniappan, 2005).

The KTCPI consists of 50 items for some thing about my self that require yes or no answers. Scoring of responses to this measure presents little difficulty and can be done by simple frequency counts of the positive responses on the total scale. There is no time limit for the scale but most subjects complete the checklist in 10 to 20 minutes. Scoring responses to items is done by counting the number of positive responses, giving a credit of 1 for each positive response. All blank responses are scored zero (A.K. Palaniappan, 2007). However, the test was translated into Persian Language. An example of a translated item where the student is required answering ''Yes"" or ''No'' is:

''تمایل دارم نظر جدید ارائه نمایم'' or'' I like adding to an idea''

The Cronbach Alpha established in the study was 0.779.

2.2.3 Cumulative Grade Point Average (CGPA)

For the purposes of this study, Cumulative Grade point Average (CGPA) has been used as a proxy of academic achievement. The CGPA is calculated by dividing the total amount of grade points earned by the total amount of credit hours attempted.

2.3 Procedure

Every undergraduate student in the study was examined using KTCPI, CFIT-3a and CGPA. The research questions posed for the study required identifying and analyzing the distributions and regression on academic achievement. Enter linear regression analysis (with the effect size statisticR^2) was used to determine the most powerful predictors of CGPA scores using IQ, creativity scores and gender (male and female). For analysis, a probability level of .05 was chosen for statistical significance because of the large number of comparisons.

Independent and dependent variables were divided by gender, with total scores and measures calculated. The samples were selected during the regular course time. Written and oral instructions were given for all of the participants. Participants were allowed to choose to identify themselves or to answer the tests anonymously. Students received no rewards but each was given information on the detailed result of his/her tests. Scores for measures were entered into the SPSS.

A pilot study was conducted to test KTCPI (Persian language) the validity of the questionnaires and to assess the data collection procedures that were not included in the main sample. As a result of the knowledge and experience gained from the pilot study, several changes were made to improve the survey instrument and to finalize a work plan for field implementation of the data collection for the actual study. Questions on the student questionnaires were also revised to improve clarity and coherence. Pilot study also was conducted to test CFIT-3a the validity of the questioners by example figures.

3. Results

3.1 Descriptive Statistics

The data were analyzed on the basis of gender, and reported in Tables below.

Table.1 shows descriptive statistics of intelligence. The finding of this result has shown that the females' mean scores were not different (male = 104.63, female =104.38, but standard deviation and range male (SD=16.35, range= 72) are greater than the females' standard deviation (14.35) and range (60).

TABLE 1. Descriptive Statistics of Intelligence

Measure	N	Minimum	Maximum	Mean	SD	Range
Total Score	153	69	141	104.55	15.70	72
Male	105	69	141	104.63	16.35	72
Female	48	69	129	104.38	14.35	60

In this data (Table.2) the females' mean(33.21) score was greater than the males' mean(31.90) for Creativity, but the standard deviations between females and males were not too much different (males=4.36& females=4.55). In other words the range scores between two groups were the same (18).

TABLE 2. Comparisons of Creative Perception Inventory Scores of Males and Females (50 items)

Measure	N	Minimum	Maximum	Mean	SD	Range
Total Score	153	21	41	32.31	4.45	20
Male	105	21	39	31.90	4.36	18
Female	48	23	41	33.21	4.55	18

TABLE 3. Descriptive Statistics of CGPA

Measure	N	Minimum	Maximum	Mean	SD	Range
Total Score	153	1.21	4.00	2.97	0.54	2.79
Male	105	2.09	4.00	3.00	0.53	1.91
Female	48	1.21	3. 73	2.89	0.56	2.52

In this data (Table.3) the females' mean (2.89) score was lower than the males' mean(3.00) for cumulative grade point average, but the standard deviations between females and males were not higher differences (males=0.53& females=0.56). In another word the range scores female (2.52) grater than male (1.91) However, Normal P-P Plot graphs (Expected Cumulative Probability by Observed Cumulative Probability) were obtained for creativity scores is shown in Figure 1&2.

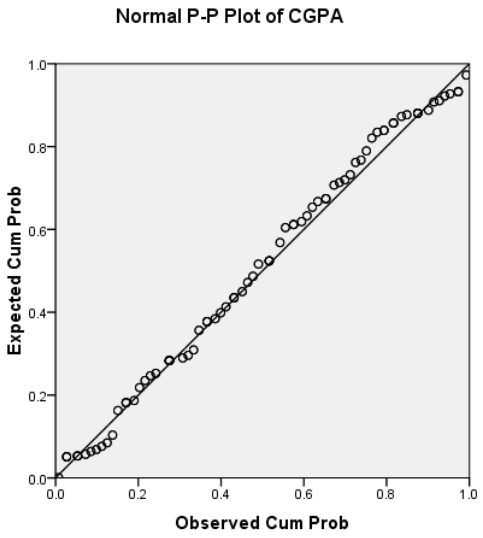

Figure 1. Dependent variable; academic achievement (CGPA). The normal plot of regression standardized residuals for the dependent variable also indicates a relatively normal distribution.

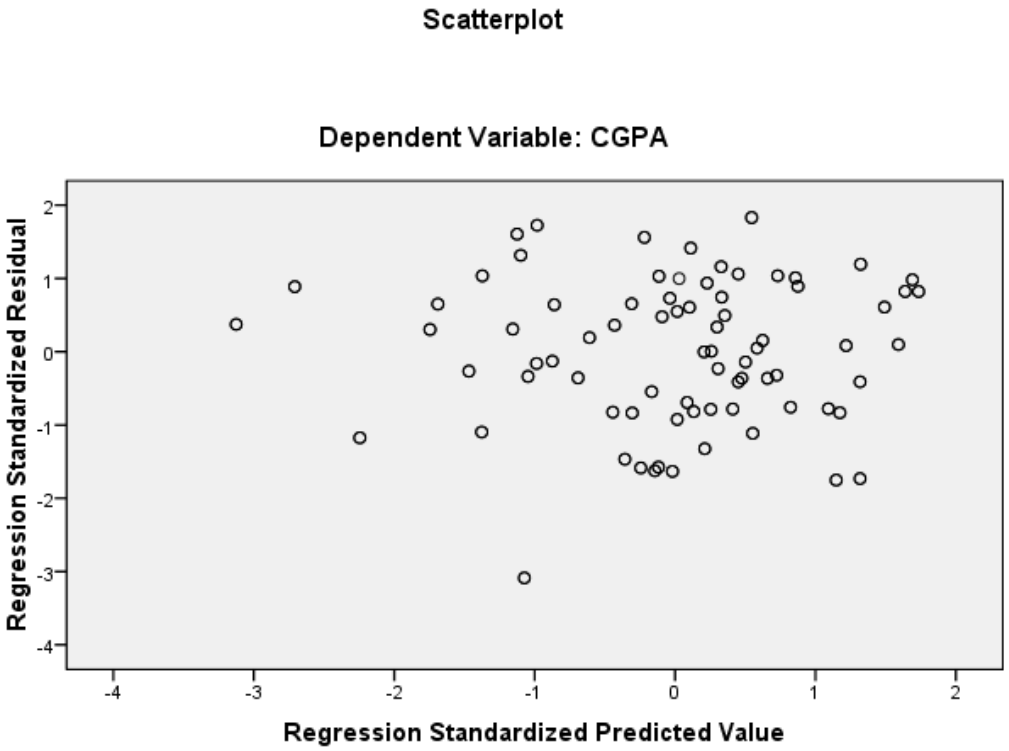

Figure 2. Regression standardized predicted value

From the scatterplot of residuals against predicted values, we can see that there is a clear relationship between the residuals and the predicted value, consistent with the assumption of linearity.

3.2 Academic achievement predictors

The following tables show multiple regressions (standard) between CGPA and scores of the intelligence, creativity and gender.Table.4 shows variables entered. For this study all requested variables (Gender, IQ, and Creativity). All independent variables (Gender, IQ, and Creativity) together explain 0.045 of the variance (R squared) in academic achievement (CGPA), which is not significant, as indicated by the F-value of 2.334 in the following tables (table.6&8).However, in table10, an examination of the t-values is not high indicates that gender and IQ contributes to the CGPA, but there was significant creativity to CGPA *(t= 2.008, P= 0.046).* Finding has been shown indicating lower correlation CGPA and independent variables this study (scores of the intelligence, creativity and gender).

Table. 5 shows variables entered (IQ and Creativity).independent variables: IQ and creativity (gender is controlled) together explain 0.010 of the variance in academic achievement, which is not significant, as indicated by the F- values 1.562 (table. 7& 9). However, in table 11, an examination of the t-values is not high. This indicates that IQ and creativity contribute to the CGPA. There also were not significant independent variables to CGPA.

3.3 Partial correlations

Partial correlations in table 11 showed that independent variables (intelligence and creativity scores and gender) was not significantly related to academic achievement (CGPA) at $P < 0.05$. According this table correlation gender to CGPA was (*Zero- order = 0.095, P < 0.05*) and correlation intelligence to CGPA was (*Zero-order = 0.101, P < 0.05*) and creativity also was not significantly related to academic achievement *(Zero-order = 0.157).* In table 11, partial correlation also showed that intelligence and creativity scores (gender is controlled) was not significantly related to academic achievement (CGPA) at $p< 0.05$.

TABLE 4. Variables Entered Removed [b]

Mode	Variables Entered	Variables Removed	Method
1	Gender, IQ, Creativity,		Enter

a. All requested variables entered
b. Dependent Variable: CGPA

TABLE 5. Variables Entered Removed [b]

Mode	Variables Entered	Variables Removed	Method
1	IQ, Creativity		Enter

a. All requested variables (IQ , Creativity) entered
b. Dependent Variable: CGPA

TABLE.6
Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.212[a]	0.045	0.026	0.52991

a. Predictors : (Constant) (Creativity , IQ and Gender)
b. Dependent Variable: CGPA

TABLE.7
Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.178[a]	0.032	0.019	0.53180

a. Predictors : (Constant) (Creativity , IQ)
b. Dependent Variable: CGPA

TABLE 8. ANOVA [b]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	1.966	3	0.655	2.334	0.076 [a]
	Residual	41.840	149	0.281		
	Total	43.806	152			

a. Predictors: (Constant, Gender, IQ , Creativity,)
b. Dependent Variable: CGPA

TABLE 9. ANOVA [b]

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	1.384	2	0.692	2.448	0.090 [a]
	Residual	42.422	150	0.283		
	Total	43.806	152			

a. Predictors: (Constant, IQ , Creativity,)
b. Dependent Variable: CGPA

TABLE 10. Coefficients [a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.		
	B	Std.Error	Beta			Zero-order	Partial
1 (Constant)	1.811	0.448		4.40	.000		
IQ	0.003	0.003	0.82	1.015	0.312	0.101	0.083
Creativity	0.020	0.010	0.163	2.008	0.046	0.157	0.162
Gender	0.134	0.093	0.116	1.439	0.152	.095	0.117

TABLE 11. Coefficients [a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.		
	B	Std.Error	Beta			Zero-order	Partial
1 (Constant)	2.092	0.405		5.160	.000		
IQ	0.003	0.003	0.85	1.046	0.297	0.101	0.085
Creativity	0.018	0.010	0.147	1.819	0.071	0.157	0.147

Dependent Variable : CGPA

4. Discussion and Conclusion

Findings from the present study demonstrate that on the whole, the independent variables were not directed to predictor's academic achievement. Multivariate regression (enter) analysis (using IQ, creativity and gender as predictors) was conducted to predict academic achievement (CGPA). IQ, creativity and gender was not predictor of academic achievement (explaining 0.045 of the variance). Partial correlations between academic achievement and IQ, creativity scores and gender were non significant at .05. Coefficients also showed there is no significance between academic achievement and IQ and gender at .05, except for creativity (*t= 2.008, p= 0.046).* In conclusion, our finding not support the importance of IQ , creativity and gender in predicting academic achievement scores but support only significance of creativity to CGPA at $p< 0.05$.

Previous studies showed prediction between IQ / creativity and academic achievement but earlier studies did not examine IQ, creativity and gender to predict academic achievement (CGPA). The relation significance of IQ in determining academic achievement is consistent with result from previous researches (Gagné & St Père, 2002; Laidra et al., 2007; Mayes & Calhoun, 2007a, 2007b; McGrew & Flanagan, 1997; Neisser et al., 1996). Past studies also showed a relationship/ predict between creativity and academic achievement (Aitken Harris, 2004; Cicirelli, 1965; Hirsh & Peterson, 2008b).

The result provided some initial data supporting the use of the Cattell Fair Culture Intelligence Test and Creative Perception Inventory as self report measure of intelligence and creativity. The CGPA also was measured of academic achievement. However, the lack of performance – based or objective criterion measures of the intelligence and creativity which self report data of the IQ and creativity could be compared was a major limitation of the study. The fact that the conventional measure of IQ, creativity, and academic achievement were not predictable from CGPA of students might have to do with the control in the range of these scores in this specific population of highly academic achievement, which was another limitation of the study. Thus, the need for future replication studies using more representative samples then the present samples. Such assessment of the academic achievement with objective performance-based measures by judges such as academic achievement tests, teachers, and parents will aid to overcome some of the limitations of the study.

Future studies also are needed to determine the relative significance of creativity, IQ and gender in predicting other area of CGPA, together with academic achievement tests, written expression, reading compression, mathematics and sciences achievement. Future studies should effort to better separate discrete abilities and measure their prediction to academic achievement.

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Corresponding Authors:
Dr Rohani Abdullah Department of Human Development & Family Studies, University Putra Malaysia, Serdang 43400, Malaysia, Tel; +6038946538

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