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Procedia - Social and Behavioral Sciences 29 (2011) 1689 – 1692

**Procedia**  
Social and Behavioral Sciences

International Conference on Education and Educational Psychology (ICEEPSY 2011)  
**The mediating role of academic self-efficacy in the relationship  
between personality traits and mathematics performance**

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**Abstract**

Conception of individual differences in learning mathematics is an important issue in educational psychology. The present research investigated the mediating role of academic self-efficacy in the relationship between the personality traits and mathematics performance. Participants were 367 (girls, 187 and boys, 180) selected from pre-university in Shiraz. They completed the Goldberg's Personality traits Scale (1999) and & Greene et al.' Academic Self-efficacy Scale (2004) and their mathematics' score was used as a criterion of mathematics performance. The path diagram of hypothetical model was tested by simultaneous regression analysis. Results showed that the significant relationship between variables of research and also the mediating role of academic self-efficacy.

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Selection and/or peer-review under responsibility of Dr Zafer Bekirogullari.

*Keywords* : personality traits, academic self-efficacy, mathematics performance

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**1-Introduction**

One of the most common approaches to the study of mathematics performance is to distinguish strong and weak students based on their mathematical outcomes or teacher perceptions and then to identify the personal characteristics that differentiate the two groups. Digman & Inoye (1986) believed that describing of characteristic could be explained by Five strong factors. One of the most influential characteristic theories is Five-Factor Model of personality or Big Five. This model identifies that the human is sensible and can express his characteristics and behaviour. According to this theory, the human can realize his life style and is able to analyze his actions and reactions (McCrae & Costa, 1987). Each of the FFM's five dimension-Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness has a short definition (McCrae & John, 1992). Extraversion's (vs. Introversion) facets can be described as gregarious, assertiveness, activity, excitement-seeking, positive emotions, and warmth. Agreeableness contrasts a pro-social and communal orientation toward others and includes traits such as altruism, tender-mindedness, trust, and modesty. The facets of agreeableness can be described as trust, straightforwardness, altruism, compliance, and modesty. Conscientiousness describes socially, prescribed impulse control that facilitates task and goal-directed behaviour, such as thinking before acting, delaying gratification. Conscientiousness facets are competence, order, dutifulness, achievement striving, self-discipline, and deliberation. Neuroticism contrasts emotional stability and even-temperedness with negative emotion, such as feeling anxious, nervous, sad, and tense. Neuroticism has facets such as anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability. Openness to experience describes the breadth, depth, originality, and complexity of an individual's mental and experiential life. Openness ascribes to facets such as ideas, fantasy, aesthetics, actions, feelings, and values. In some researches, personality trait is assumed as a predictive variable. The relationship between FFM and the variables related to educational situations found such as creativity and divergent

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thought(McCrae, & Costa, 1987); styles of attitudes(Zhang, 2002, 2003; Zhang, Huang, 2001); academic achievement (Digman, & Inoye, 1986; DeRead,& Shouwenburg, 1996) ; and motivation of achievement (Busato, Pins, Elshout, & Hamaker,1999). Also Poropat(2009) found that academic performance had correlated significantly with agreeableness, conscientiousness, and openness.

Self-efficacy is the other component that influences the mathematics performance. Self-efficacy is differentiated from the social cognition theory of the famous psychologist, Albert Bandura (1997), that indicates the individual beliefs and judgments about his capability of doing his responsibilities and tasks. Believing in self-efficacy influences many aspects of the life such as choosing goals, decision making, endeavor level, level of continuity and stability and encountering with challenging problems (Bandura, 1991). Self-efficacy exists in diverse branches. Academic self-efficacy is a type of self-efficacy that the experts pay attention to it. Academic self-efficacy has been defined as personal judgment of one's capabilities to organize and execute courses of action to attain designated types of educational performance(Zimmerman,1995). Academic self-efficacy has been reported to promote academic achievement directly by increasing academic aspirations and pro-social behavior(Bandura, Caprara, Barbaranelli,Pastorelli,1996). Bandura (1997) recognized that students who have stronger self-efficacy cooperation in doing educational assignments than students who have less self-efficacy(Pintrich, & Schunk,2002). Also self-efficacy beliefs can predict student's performance in mathematics( Bandura,1986) such as mathematics problem solving, self-concept, self-regulatory, and decreases mathematics anxiety( Pajaris &Miller, 1994) , It has also demonstrated that students whose self-efficacy is stronger and more accurate in their mathematics computation , show greater persistence on difficult items than do students with low self-efficacy(Collins, 1982).

The purpose of this study was to examine whether mathematics performance could be predicted by FFM and academic self-efficacy. Also it investigated the mediating role of academic self-efficacy between FFM and mathematics performance.

## 2.Methods

Participants of this study were 367 students (girls 187 and boys 180), aged 17- 18 years that selected by multi-stages cluster random sampling; from pre-university of two regions in Shiraz .

### 2.1. Measures

#### 2.1.1. personality traits scale (Goldberg ,1999)

Goldberg scale (1999) is comprised of 50 items scale and comprises five subscales. The reliability of the measure examined by internal consistency Chronbach alpha method. Alpha coefficient for: extraversion was 0.77 , agreeableness was 0.80, conscientiousness was 0.80 , neuroticism was 0.88, and openness was 0.78.

#### 2.1.2. Academic self-efficacy scale(Greene et al,2004)

This scale includes 7 items and a five-point Likert response format ranging from zero (“absolutely disagree”) to four (“absolutely agree”). Chronbach alpha coefficient was 0.75.

#### 2.1.3. Mathematics performance scale

Mathematics scores of students were used as a criterion of mathematics performance.

## 3.Results

The correlation matrix of the variables of this research are shown in Table 1.

Table 1. Correlation matrix of mathematics performance, academic self-efficacy & FFM

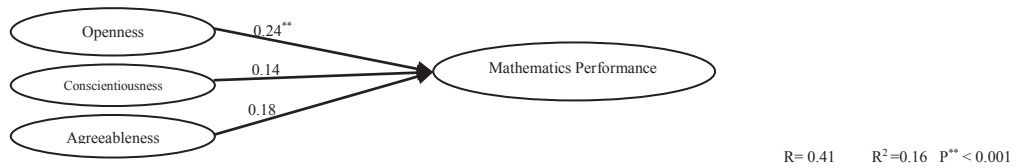
Variable	1	2	3	4	5	6	7
1. Mathematics performance	1						
2. Academic self-efficacy	0.49**	1					
3. Openness	0.39**	0.36**	1				
4. Emotional stability	0.01	0.11	0.00	1			
5. Conscientiousness	0.18**	0.39	0.04	0.18	1		
6. Agreeableness	0.28**	0.21**	0.31**	0.14	0.04	1	
7. Extraversion	0.05	0.14	0.00	0.01	0.05	0.05	1

P\* < 0.05 P\*\* < 0.001

In order to examine the relationship between research variants and credibility of research's questions, simultaneous hierarchical regression of Baron and Kenny(1986) were used during four stages :1- Simultaneous regression of mathematics performance on FFM. 2- Simultaneous multiple regression of academic self-efficacy on FFM. 3- Simultaneous multiple regression of mathematics performance on FFM and academic self-efficacy. 4- Comparing

the first and third stages: if regression coefficient is reduced from first stage to third one, then academic self-efficacy has a mediating role between mathematics performance and FFM.

The result of simultaneous multiple regression of mathematics performance on FFM with ( $\beta$ ) is shown in figure1.



Simultaneous multiple regression of mathematics performance on the FFM subscales, revealed that the openness, conscientiousness, and agreeableness were significant positive predictor for FFM.

The result of simultaneous multiple regression of academic self-efficacy on FFM is shown in figure2.



Simultaneous multiple regression of academic self-efficacy on the FFM subscales, revealed that the openness and agreeableness were positive significant predictors for academic self-efficacy.

The result of simultaneous regression of mathematics performance on FFM and academic self-efficacy is shown in figure 3.

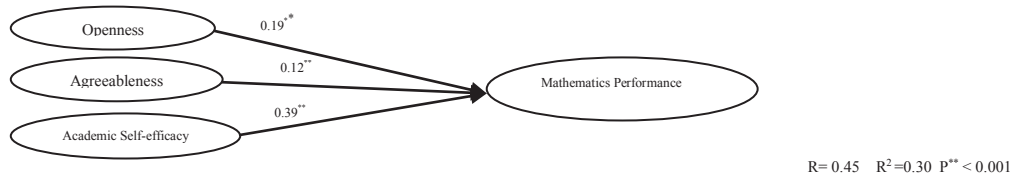
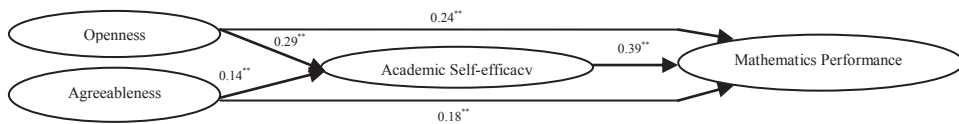


Figure 3 indicates that openness, conscientiousness, and academic self-efficacy were significant positive predictors for mathematics performance. With comparing Figure 1 and Figure 3 and also Beta coefficient, based on Baron & Kenny(1986), we conclude that academic self-efficacy has a mediating role between mathematics performance and FFM via openness to experience and agreeableness. The final model of study is shown in figure 4.



**4. Discussion**

The purpose of this study was to discover whether academic self-efficacy plays the mediating role between FFM and mathematics performance, and which factors of FFM are stronger predictor for academic self-efficacy and mathematics performance. The result of present study showed that there was a positive and significant correlation between openness to experience , conscientiousness , agreeableness of FFM and mathematics performance.

The relationship between openness and learning was supported by that of (Zhang, 2002, 2003, Entwistle, & Tait, 1995, McCrae, & John, 1992). Also excellent ideas and openness ( Blickle, 1996), and analyzing arguments and openness(Schouwenburg 1995)has been considered. Openness to experience is described by imagination, intelligence, and curiosity(Costa, &McCrae, 1992).These people have positive attitude about learning experiences and new ideas. Since mathematics is linked to creativity, curiosity, and analyzing arguments, openness can be a positive and meaningful predictor in learning mathematics. Another outcome of this study was the positive significant relationship between conscientiousness and mathematic performance. The conscientious people are described by certain characteristics: self-disciplined, dutifulness (Costa and McCrae 1992), and concentration on studying (Schouwenburg 1995). While succeed in mathematics requires discipline and concentration on the subject,

one can conclude that conscientiousness is a positive and meaningful predictor in mathematic performance. It has also been observed, that the factor of agreeableness is positively and meaningfully a predictor of mathematical functions. Agreeable people are more flexible in facing life's challenges (Costa and McCrae 1992), they are also able to apply learning in their real life (Kolb, 1984). Since mathematics is followed by challenges, exam stress, or problem solving agreeable people can thoroughly reconcile themselves in coping with these mathematical problems. It was also observed that there is a positive significant relationship between self-efficacy and mathematics performance. As expected academic self-efficacy had a strong relationship with academic achievement (Bandura, Barbaranelli et al., 2001, Bandura, Caprara et al., 2001, Chemers et al., 2001, Green et al., 2004, Multon et al., 1991, Robbins et al., 2004, Wood & Lock, 1987, as cited in Corroll et al., 2009). The important result of this study was the mediating role of academic self-efficacy between FFM & mathematics performance by openness to experience and agreeableness. The predicting power of mathematics performance on FFM & academic self-efficacy was examined in figure 3. Agreeableness ( $\beta = 0.12$ ,  $p < 0.001$ ), openness ( $\beta = 0.19$ ,  $p < 0.001$ ), and academic self-efficacy ( $\beta = 0.39$ ,  $p < 0.001$ ) were positive significant predictor for mathematics performance. Comparing the  $\beta$  coefficient (for openness decrease from 0.24 to 0.19, and for agreeableness decrease from 0.18 to 0.12) and using Baron & Kenny (1986) stages (compare figure 1 & 3), we can conclude the mediating role of academic self-efficacy between FFM & mathematics performance. The findings of this study indicates that noticing the individual differences in academic environment is very important. Also the more increasing in self-efficacy via educational workshops, the more upbringing the positive traits.

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