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The relation among achievement goals and academic achievement in statistics: the mediating role of statistics anxiety and statistics self-efficacy

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Abstract

In order to predict student's academic achievement in statistics in terms of achievement goals, statistics anxiety and statistics self-efficacy, 323 participants from Fars Peyame Noor Universities were selected via multi-stage cluster sampling and then were asked to fill in a set of questionnaires, consisted of achievement goals, statistics anxiety and statistics self-efficacy scales. Results of path analysis generally showed that achievement goals indirectly and through statistics anxiety and statistics self-efficacy affect students' achievement in statistics. Moreover, results showed that unlike avoidance-performance goals, the indirect effect of mastery goals on statistical achievement is positive.

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1. Introduction

Few researches in Iran have studied learner's educational performance in statistics. For most of learners understanding statistics is very hard, so that they have weaker performance on statistics than other educational exams (Anogbazi and Seaman, 1995). It can be mentioned that some of the most important factors which can explain lower performances on statistics are cognitive and motivational factors. In order to describe and explain educational performance, cognitive and motivational analyses have been conducted since 1980. Using a social-cognitive perspective, Value-expectancy model tries to study the way in which learners interpret meanings of their experiences in achievement situations. Motivational factors of this theory are divided into value, expectancy and emotion: Value consists of learner's goals about importance and interest in the task. In this study Achievement goals are considered as one of the sub-components of value. Basically, achievement goal refers to learner's reasons behind doing a task (Dweck and Leggett 1988,; Ames and Archer, 1992; Braten & Stramso, 2003). Achievement goal theory assumes that learner's intentions for doing a task are important predictors for processes and results of their achievements (Ames, 1992; Dweck and Leggett, 1988; Nicholls, 1979). Three of the most the achievement goals which have been frequently studied are mastery, approach-performance and avoidance-performance goals. Learners, who have mastery goals, focus on developing their capabilities in an educational task. Those who have approach-performance goals compare their performances with others. However, those who have avoidance-

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performance goals try to obtain good social judgments in order to avoid punishment. Results show that choosing any of these goals results in different cognitive, emotional and behavioral outcomes (Elliot, 1999; Shank et al, 2008). Some studies have perused the relation among achievement goals and educational performance. For example, results showed that mastery goals (Church, Elliot and Gable, 2001; Wolterz, Pintrich and Ryan, 1996; Rastegar, 2008) and approach- performance goals (Elliot and McGregor, 2001; Harachkewicz et al, 1997, 2000; Hejazi et al, 2008) are positively, and avoidance- performance (Elliot and McGregor, 1999; Church, Elliot and Gable, 2001; Elliot and Church, 1997; Rastegar et al, 2010, 2008; Hejazi et al, 2008) goals are negatively related to educational performance. Meanwhile other studies have achieved opposite results. For example, in some studies the relation among mastery goals (Wigfield and Eccles, 2000) and approach-performance goals with educational performance wasn't approved. The same results were obtained for the relation among avoidance- performance goals and educational performance.

Expectancy consists of learner's beliefs regarding his ability. It includes learner's answer to the question: can I do this task? (Pintrich and De Groot, 1990). Given this matter and in order to explain learner's performance on statistics, statistical self efficacy- individual's believes about his/her abilities in solving statistical problems, doing the task and being successful in statistics lesson- are considered. According to Bandura's social- cognitive theory (1997), value- expectancy theory (Wigfield and Eccles, 2000) and results of some studies, self efficacy has an important role in educational achievement (Green et al, 2004; Mohsen pour et al 2006, Rastegar et al, 2010). Additionally according to value- expectancy theory (Wigfield and Eccles, 2000), learner's goals in learning process, determine their self efficacy. Accordingly, results of some studies approve positive relation among mastery goals (Kaplan and Meyher, 1999; Schank, 1996; Pajares et al, 2000; Mohsen Pour et al, 2006; Rastegar et al, 2010) and approach- performance goals (Midgely, Anderman and Hicks, 1995; Midgely and Urdan, 1995; Rastegar et al, 2010) with educational self efficacy. The relation among avoidance- performance goals and educational efficacy wasn't approved in Kaplan and Meyer (1999) research as well. However according to Midelton and Migley (1997) this relation is negative. Emotion consists of learner's affective and emotional reactions. One of the most frequent reactions is related to statistical anxiety, which is defined as: facing anxiety while dealing with statistics lesson or performing an analysis (Cruise, Crash and Bolton 1985). Results of some studies indicate a negative relation between statistical anxiety and learner's educational performance in statistics lesson (Elmore, Lewis and Bay, 1993; Lalonde and Gardner, 1993; Anogbazi and Seaman, 1995; Zeidner, 1996). Although the relation among achievement goals and statistical anxiety hasn't been considered by researchers, however some researchers have studied the relation among achievement goals with other anxiety states. According to the results, the relation among mastery goals with exam anxiety (Pintrich and DeGroot, 1990; Skaalvik, 1997) and computer anxiety (Jahromi et al, 2010) is negative and the relation among avoidance- performance goals with exam anxiety (Skalvik, 1997) and computer anxiety (Jahromi et al, 2010) is positive. The relation among approach- performance goals and exam anxiety is positive as well (Pintrich and Degrotte, 1990; Skalvik, 1997). These results are congruent with Dweck's social- cognitive approach propositions. The relation between exam anxiety and educational self efficacy is negative as well (Spielberger 1980; Dweck and Legget, 1988; Laura, 2006). At last, given the paradox in results regarding the relation among achievement goals and educational performance, and the relation among achievement goals and educational self efficacy at one end, and the relation between educational self efficacy with educational achievement at the other end, hence given the relation among achievement goals and with anxiety and computer anxiety with educational achievement; according to the theoretical and experimental literature (value- expectancy theory), the mediatory role of statistical anxiety and anxiety among achievement goals and educational performance among Peyam Noor university students is studied in the present research. Based on this aim, a model which has been derived from theoretical and experimental literature is considered as the input model (diagram 1). After evaluating the existing relations among variables, coefficients will be estimated and finally the model will be fitted. Diagram-1 conceptual path model about effective variables on educational progress on statistics (input model)

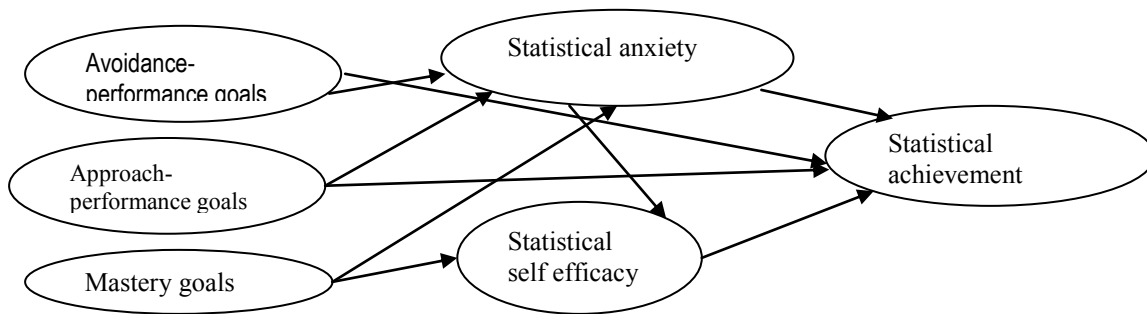


Diagram-1 conceptual path model about effective variables on educational progress on statistics (input model)

2-Method

Methodologically, this research is a descriptive research, while research design is a correlation research. Because relations among variables are analyzed within causal model.

2-1- participants

In order to select the sample, multi stage cluster sampling was used. Since Peyam Noor university centers are not concentrated in Fars province, reaching all the members of the society was not feasible (both practically and economically). So that each of geographical sides (north, south, east and west), of Fars province were considered as a cluster. Since students population and number of university centers in each side are relatively the same, so that a university center from each side were randomly selected. At the next step, two classes of inferential statistics were randomly selected. Totally, 10 classes include 323(100 male and 223 female), students were selected as the sample of study.

2-2-Measures

In order to collect data, statistical anxiety(self report)questionnaire(STARS), by Cruse et al(1985), self efficacy for learning statistics(SELS),by Sara,J,Finni and Gregory Shraw(2003), and achievement goals by Midelton and Migley(1997) were used. These questionnaires were given to the students at the start of the semester. Participants’ final grade on inferential statistics was considered as educational achievement index. In order to determine reliability coefficient of the subscales Cronbach Alpha (α), were used. The reliability coefficient for mastery goals, approach- performance, avoidance- performance, statistical anxiety and statistical self efficacy scales were respectively 0.78,0/73,0/76,0/75 and 0/79. For statistical anxiety questionnaire, content validity based on experts’ opinions was determined. For the rest of scales, structure validity (via confirmatory factor analysis) was used. Fitness indices of confirmatory factor analysis are given below (table-1).

Table1: fit indices of confirmatory factor analysis

Fitness indices	Achievement goals	Self efficacy
χ^2/df	2/16	1/02
RMSEA	0/05	0/009
GFI	0/96	0/99
AGFI	0/94	0/98

3-Results

Since matrix of correlation is the basis for path analysis, matrix of correlation for the research variables has been presented below (table-2).

Table-2-research variables matrix of correlation

Variables	1	2	3	3	5	6
Avoidance-performance	1					
Approach-performance	0/04	1				
Mastery goals	0/03	0/01	1			
Statistical anxiety	0/30**	0/16**	-0/6	1		
Statistical self efficacy	-0/05	-0/17**	0/34**	-0/21**	1	
Educational performance on statistic	-0/31**	-0/16**	0/12	-0/41**	0/47**	1

P<0/05 ** p<0/01*

As it can be seen in the above table(table-2), statistical self efficacy has the highest correlation coefficient with educational achievement on statistics(0/47),moreover, this correlation coefficient is significant as well(p<o/o1). The lowest correlation coefficient belongs to mastery goals (0.12), which is not significant. Table-3 presents direct, indirect and total effects of research variables with their determined variances.

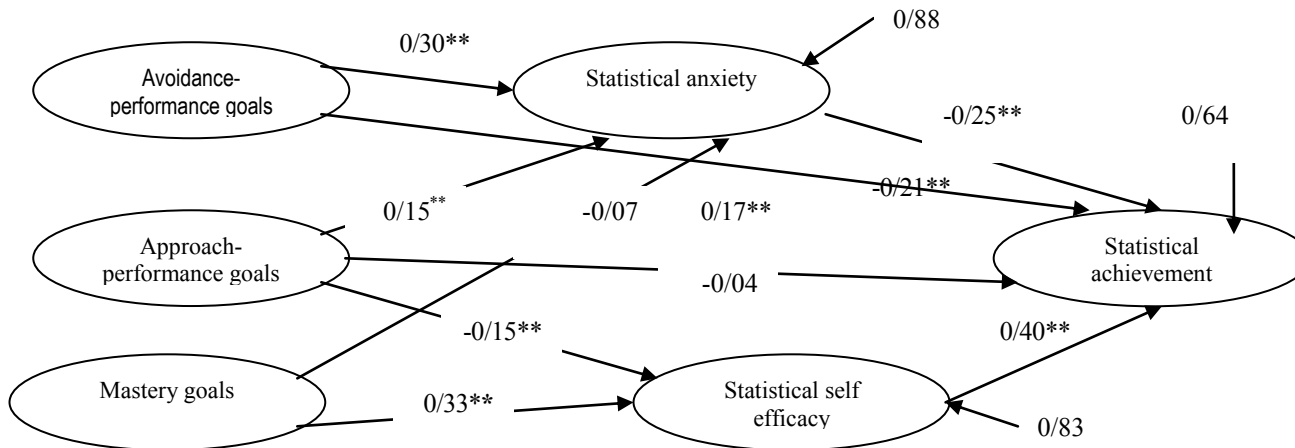
Table-3- direct, indirect and total effects of research variables

Paths	direct effects	indirect effects	total effects	R
On educational achievement on statistic from:				
Statistical self efficacy	0/40**	-	0/40**	
Statistical anxiety	-0/25**	-0/07**	-0/32**	0/36**
Mastery goals	-	0/15**	0/15**	
Approach- Performance	-0/04	-0/11**	-0/15**	
avoidance- Performance	-0/21**	-0/09**	-0/30**	
on statistical self efficacy from:				
Statistical anxiety	-0/17**	-	-0/17**	
Mastery goals	0/31**	0/01	0/34**	0/17**
Approach- Performance	-0/15**	-0/03*	-0/17**	
avoidance- Performance	-	-0/05**	-0/05**	
on statistical anxiety from:				
Mastery goals	-0/07	-	-0/07	
Approach- Performance	0/15**	-	0/15**	0/12**
avoidance- Performance	0/30**	-	0/30**	

P<0/05 ** p<0/01*

As it can be seen in table-3, among endogenous, statistical self efficacy has the highest direct and significant effect (0.40) on students’ educational achievement on statistics (p<0/01). Among exogenous variables, avoidance-performance goals have the highest direct and significant effect (-0/21) on educational achievement on statistics (p<0/01). The highest total effect on students’ educational achievement on statistics, among endogenous variables belongs to statistical self efficacy (0/40), and among exogenous variables belongs to avoidance- performance goals (- 0/30), both of them are significant. The noticeable point about indirect effects of variables on educational achievement belongs to mastery goals. That is because this variable doesn’t directly affect mastery goals, however, its indirect effect is 0/15which is significant. Given insignificance of direct effect of this variable on statistical anxiety, it can be concluded that mastery goals merely affect educational achievement on statistics via statistical self efficacy (this van be visibly seen in diagram 2). The other noticeable point is about indirect effects of avoidance-performance goals. That is because it’s direct (-0/21), indirect (-0/09) and total (-0/30) effects on educational achievement on statistics are negative and significant (p<0/01).the predicted variance of educational achievement on statistics (by the existing variables) is 36 percent.

Diagram-2 the fitted model about effective factors on educational achievement on statistics



As it can be seen in diagram-2, except for direct effect of mastery goals on statistical anxiety and direct effect of approach-performance goals on approach- performance goals on students’ educational achievement on statistics, direct coefficients of other variables on each other are significant ($p < 0/01$). Table-4 presents fitness indices of model which confirm appropriate fitness of the model with results of the research.

Table-4- fitness indices

χ^2/df	RMSEA	GFI	AGFI	CFI
1/34	03/0	0/99	0/97	1

4-Discussion

Results of path analysis showed that the proposed model fits research data well. Moreover, it showed that the research variables predict 36 percent of educational progress on statistics variance. It indicates that there are other variables which can be considered in other studies. Results didn’t confirm direct and negative effect of mastery goals on statistical anxiety; however, they confirmed direct and positive effect of avoidance- performance goals and approach- performance goals on statistical anxiety. Results regarding mastery goals are not congruent with Meece et al, 1988; Pintrich and De Grotte, 1990; Jahromi, 2010. This contradiction can be explained using Elliot et al (2010) theory, in which they differentiate between mastery-acceptance and mastery-avoidance dimensions. It means that if the differentiation be made between these two dimensions, then it is likely that the direct and negative effect of mastery acceptance goals on statistical anxiety is proven. Results regarding avoidance- performance goals are congruent with(Skalvik,1997; Jahromi et al, 2010). Results regarding approach- performance goals are congruent with Meece et al,1988; Pintrich and De Grotte, 1990; Skalvik,1997. Direct and positive effect of mastery goals on statistical self efficacy was confirmed. This finding is in the line with the results of some researchers such as: Kaplan and Maehner, 1999; Shanek,1996; Pajares et al,2000; Mouhsen Pour et al,2006, Rastegar et al,2010). Not only results regarding direct and positive effect of approach-performance goals on statistical anxiety were not confirmed, but also results confirmed negative effect of this variable on statistical self efficacy. Given this contradiction in results, it can be said that approach-performance goals are affected by the nature of learning products, individual characteristics and environmental conditions. So this contradiction can be a result of different environment of Peyam Noor University. However, it is undoubted that this finding is in the line with a presupposition of value-expectancy theory which implies that individuals’ learned goals determine their self efficacy believes. Negative and direct effect of statistical anxiety on educational achievement on statistics was confirmed as well. This finding is in the line with Spilberger’s State- trait anxiety theory(1980), and findings of Elmore, Lewis, and Bay,1993; Lalonde & Gardner,1993;Anogbazi and Seeman,1995; Zeidner,1991; Anogbazi,2003). Given these

findings, it is suggested that the educational environment and classes of statistics in Peyam Noor University should be built in the way in which student's anxiety level can be kept on the optimum level. In order to obtain this aim, special attention should be given to task difficulty level, professors' evaluations – emphasizing on their usages in psychological and educational research, using interesting tasks, giving responsibility to learners and making some opportunities for obtaining success and paying attention to individual's achievement and motivation. Results showed that statistical self efficacy has the highest indirect effect on statistical achievement. Bandura(1997) believes that having high self efficacy can change a threatening environment to a secure environment. So that it is suggested that teaching style, contents of each lesson and more importantly evaluation process in Peyam Noor university should be designed in the way in which students have the opportunity to form some positive beliefs about themselves (regarding their learning capabilities). Specially, in the case of teaching and evaluation it is recommended that more emphasis should be given to the usages of this lesson in research plans. Significance of indirect effect of goals on statistical performance indicates the mediatory role of anxiety and self efficacy among these variables. According to this finding, those students who concentrate on developing their knowledge and obtaining a skill, will form positive attitudes about their capabilities in learning statistics and thereafter will experience better progress. When students concentrate on social judgments of their performances on statistics with the others, rivalry feelings are provoked and as a result they become anxious, which in turn results in decreasing students' performances. Finally, when students concentrate on avoiding of failure and other peoples' sarcasms, as a result they become more anxious and form a negative perception about their capabilities. On this matter, Elliot (1999) and Schank et al(2008) declare that choosing achievement goals in educational environment are determined by many different variables which come ahead of this kind of choice. This selection results in forming distinguished paradigms of cognitive, emotional and behavioural outcomes. Additionally, above mentioned findings are in the line with presuppositions of value-expectancy theory (Wigfield and Eccles, 2000) and achievement goals theory. One of the most important findings of this study indicates that all three effects of avoidance- performance goals(direct, indirect and total effects) on educational progress on statistics are negative. This shows deleterious effects of this kind of goals- selection in educational environments. Results of some studies such as :Elliot and Mc Gregor(1999); Elliot and Church(1997); Church, Elliot and Gable(2001); Wolters(2004); and Hejazi et al(2008) , indicate negative and deleterious effects of avoidance- performance goals on educational achievement. Researchers believe that one reason behind student inclination toward avoidance- performance goals and approach- performance goals is individuals' tendency toward social comparisons which can intensify rivalry. Unfortunately, universities intensify this phenomenon further unintentionally. Among other possible explanations of this matter, it can said that blaming a learner just after a failure, which can be intentionally or unintentionally, by his/her social environment is very effective. Anyway given the findings, parents, professors and planners in universities should provide an environment in which push learners toward mastery goals. In this way, concentration on improving or obtaining new skills, avoiding unnecessary competitions and modifying evaluation system toward different levels of cognitive, emotional and psychomotor domains will be helpful. Similarly and alongside focusing on practical subject matters which are based on realities of life, Peyam Noor University should form a new perspective for its learners in which they perceive that universities develop social responsibility and individual's understandings about the world.

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