The role of achievement goals, academic motivation, and learning strategies in statistics anxiety: testing a causal model

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Abstract

The present study aims at analyzing the effect of achievement goals on statistics anxiety through academic motivation and statistics learning approaches. In doing so, 345 undergraduate students (68 male and 277 female) from the faculties of psychology and educational sciences of Tehran city were selected using census sampling method. The participants answered the questionnaires prepared on achievement goals, academic motivation, learning strategies and, statistics anxiety. The Path Analysis method indicated that mastery goals have direct negative effects on statistics anxiety \( (p<0.05) \). Performance-Approach and Performance-Avoidance goals affect on statistics anxiety only through extrinsic motivation and cognitive strategies. Mastery as well as Performance-Approach goals have direct positive effects on intrinsic motivation and the extrinsic one respectively \( (p<0.05) \). All the three variables of academic motivation directly influence statistics anxiety. Intrinsic motivation influences the meta-cognitive strategies and the extrinsic motivation and a-motivation affect the learning strategies directly and positively. All in all the findings indicate that achievement goals affect statistics anxiety more often through academic motivation and learning strategies.

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Keywords: Achievement Goals; Academic Motivation; Learning Strategies; Statistics Anxiety;

1. Introduction

When we talk about anxiety in educational environments, it could have completely distinct and clear outcomes and results on education and learning. For example, anxiety is one of the most important motivation and cognition variables that affect considerably educational progress, learning, performance and also learners' attention, concentration, and information retrieval (Schunk et al. 2008; Bembenutty, 2008; Bas, 2010).

Among the most important state anxieties pertinent to education are the situations and problems of statistics which is considered by a large number of the students a highly stress-producing and distressing phenomenon (Wang et al. 2009). Statistics anxiety has been defined as a state anxiety, since this kind of anxiety occurs when the student is learning statistics concepts and terms and also its application in a special context. Some evidences indicate that nearly 66 to 80 percent of the students experience a high level of statistics anxiety when facing statistics' concepts and subjects and also evaluations related to this course (Baloglu, 2003). Some researchers believe that many students describe statistics as the most distressing course in their academic studies (Bandalos et al. 2003)

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Although statistical science as well as its application are among the important unavoidable courses for the students of psychology and educational sciences and also it is quite clear that statistical concepts reinforce students reasoning power and critical thinking (Baloglu, 2003), a great number of the students have not yet understood it or they feel considerably anxious about it and call this course as the most detestable course in their academic studies.

1.1. Statistics Anxiety

Statistics anxiety has been defined as some special feelings of anxiety that the students experience in dealing with statistical matters such as collecting, processing, and interpreting data (Cruise, 1985; Hanna et al. 2008). From the very beginning statistics anxiety was defined as a multidimensional variable over the multidimensionality of which most of the scholars are unanimous. Cruise and Wilkins (1980), and Hanna et al. (2008) have all identified 6 components or variables for statistics anxiety and any of them have studied a different dimension of this variable. These six dimensions of statistics anxiety include: Worth of Statistics, Test and Class Anxiety, Fear of Asking for Help, Interpretation Anxiety, Computational Self-Concept, and Fear of Statistics Teacher.

1.2. Achievement Goals

This theory presented by Dweck (1986) and Nicholls (1984) involves the specific state orientations that indicate the tendency for progress, growth, knowledge achievement or showing one's competence in a specific context or setting (Ames, 1992; Kaplan and Flum, 2010). Midgley, Kaplan, and Middleton (2001) identify achievement goals as behavioural goals that are understood or followed by the individual in competence attitude context. Elliot (Elliot et al: 1997) as well as Kaplan (Kaplan et al. 2002) have proposed the 'Three-Part Achievement Goals Framework: Performance-Approach Goals, Performance-Avoidance Goals, and Mastery Goals. Findings of most of the studies done concerning achievement goals and other variables indicate that mastery goals have a positive relationship with high 'self-efficacy', learning meta-cognitive strategies, high grades and generally with their psychological social well-being (Dweck and Leggett, 1998; Kaplan and Flum, 2010). Avoidance goals have a positive relationship with employing superficial learning strategies (Liem et al. 2008), learning intrinsic motivation decrease, low grades and generally all of the negative emotions (Nien and Duda, 2008; Ames, 1992; Ott, & Tavella, 2010).

On the other hand since performance-approach goals are connected with a combination of positive and negative patterns and outcomes, there is not much coordination in the researchers' findings, i.e., the students with performance-approach goals experience both the positive emotions such as deep learning strategies, and intrinsic motivation increase as well as the negative emotions such as anxiety and jealousy. (Lee et al. 2010; Vosloo et al. 2009). According to the research findings that have studied the relationship between achievement goals and anxiety, one can claim that there is a negative relationship between mastery goals and anxiety (Putwain and Daniels, 2010), an insignificant positive relationship between performance goals and anxiety, and a significant positive relationship between avoidance goals and anxiety (Elliot and Church, 1997).

1.3. Academic Motivation

There are various theories concerning academic motivation, but in this study it is defined based on the "self-determination theory" that was developed by Deci and Ryan (1985). Self-determination theory (SDT) is a motivation theory that systematically demonstrates man's progressive, motivate, emotional, and social well-being needs in the society's essential and immediate context. This model claims that a complete analysis of motivation process must take into consideration three important entities i.e., intrinsic motivation, extrinsic motivation, and a-motivation (Vallerend et al. 2010). Intrinsic motivation refers to a motivation that drives individuals toward performing a specific homework and duty spontaneously and intrinsically and apart from the extrinsic rewards of performing the homework itself, it is valuable a satisfactory for the individual (Deci and Ryan, 2000). Generally speaking, extrinsic motivation refers to a motivation that makes individuals do a specific duty or homework for the sake of rewards and extrinsic factors. When people are motivated extrinsically, they tend to attempt for achieving something beyond the pleasure of the duty or activity itself (Lee et al. 2010). The element of extrinsic motivation is divided into four sub-elements that continuously range from the highest level of autonomy (integrated regulation) to the lowest level of autonomy (extrinsic regulation) i.e., in extrinsic motivation, the individual will move toward a-motivation if he has a lower degree of autonomy, and in case of having a higher degree of autonomy, he/she will
move toward an intrinsic motivation. A-motivated individual is referred to someone who has not received any motivation (i.e., neither intrinsic pleasure and value nor extrinsic motivations) for performing his/her activities and thus avoids from doing any kind of activity (Deci and Ryan, 2000; Clark and Schroth, 2010). Generally the findings of the studies done concerning the academic motivation and anxiety indicate that intrinsic motivation has a positive relationship with health indices such as responsibility, and self-flourishing while extrinsic academic motivation and a-motivation have a positive relationship with the incompatible behaviours” indices such as anxiety, alcohol abuse, and indifference towards responsibility (Deci and Ryan, 2000).

1.4. Learning Strategies
Weinstein et al. (2010) maintains that learning strategies include emotional, motivational, meta-cognitive, cognitive, and behavioural activities and processes that facilitate significant understanding, learning and processing as the integration of the new knowledge in mind. Based on the level of learning control and its importance in performing duties, learning strategies are divided into cognitive and meta-cognitive ones. Cognitive strategies refer to any kind of behaviour, thought, or action that learners employ when they are trying to learn and the goal of which is to help learning, organizing and developing sciences and skills as well as facilitating their use in the future (Weinstein et al. 2010). According to Flavell (1998) meta-cognition is the individual's knowledge about the process of thinking, learning activities and practicing control over them. Meta-cognitive strategies help learners focus their attention for understanding the content, connecting the previous and new knowledge and skills and encoding and processing them as well. Generally most of the research findings concerning learning strategies and anxiety suggest that anxiety has considerable and determining influences on students with low learning skills (Tobias, 1985) and involves in focusing as well as processing data (Schunk et al. 2008). With respect to the above-mentioned points, so the main issue of the present study is: "studying the effects of three variables i.e., achievement goals, academic motivation, and learning strategies on statistics anxiety".

2. Methodology
2.1. Design
The method adopted in the present study is a descriptive (non-experimental) one and the research design is path analysis correlation because in this study the relationships among the variables are discussed in a causal model.

2.2. Population and Sampling
The population includes all male and female undergraduate students of educational sciences and psychology in the state universities of Tehran (about 350 students) who had registered for two courses i.e., descriptive statistics and inferential statistics in the first semester of the 2009-2010 academic year.

2.3. Instruments
In the present study Middleton and Midgley's questionnaire was used for measuring achievement goals. In the present study in respect of the research subject subscales of mastery goals, performance-approach goals, and performance-avoidance goals were employed. For determining this scale's reliability Cronbach's alpha method was adopted. In the present study the reliability coefficient of the three subscales of mastery goals, performance-approach goals, and performance-avoidance goals are 79%, 85%, and 81% respectively.

For measuring the academic motivation Vallerend's (Vallerend et al. 1992) Academic Motivation Scale was employed. In this study Cronbach's alpha rate for subscales of intrinsic motivation, extrinsic motivation, and a-motivation are 84%, 86%, and 67% respectively.

In this study MSQL was used for measuring learning strategies. In this study the subscale of cognitive and meta-cognitive strategies was employed. In the present study Cronbach’s alpha scale for cognitive and meta-cognitive subscales was measured at 0.85 and 0.80 respectively.

For measuring students' statistics anxiety, Statistics Anxiety Rating Scale (STARS) Cruise (Cruise et al. 1985) was used. Statistics anxiety rating scale is a 51-question questionnaire that is developed in a Likert five-degree approach. In this study Cronbach's alpha scale was measured at 0.90 for the subscales of statistics value, interpretation anxiety, test and class anxiety, computational self-concept, fear of asking for help, and fear of statistics teacher.
3. Research Findings

First descriptive indices (mean, standard deviation, skewness, and kurtosis) for the whole sample were studied and reported in Table 1. With regard to the collected data, correlation coefficients of studied variables were measured and shown in Correlation Matrix (Table 2).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery Goals</td>
<td>13.45</td>
<td>5.51</td>
<td>0.23</td>
<td>-1.19</td>
</tr>
<tr>
<td>Performance-approach</td>
<td>10.84</td>
<td>4.62</td>
<td>0.23</td>
<td>-1.10</td>
</tr>
<tr>
<td>Performance-avoidance</td>
<td>8.53</td>
<td>3.53</td>
<td>0.09</td>
<td>-1.20</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>27.56</td>
<td>10.58</td>
<td>0.64</td>
<td>-0.52</td>
</tr>
<tr>
<td>Extrinsic Motivation</td>
<td>28.85</td>
<td>9.79</td>
<td>0.554</td>
<td>-0.28</td>
</tr>
<tr>
<td>Amotivation</td>
<td>12.57</td>
<td>3.85</td>
<td>-0.15</td>
<td>-0.67</td>
</tr>
<tr>
<td>Meta-cognition</td>
<td>29.3</td>
<td>10.29</td>
<td>0.51</td>
<td>-0.55</td>
</tr>
<tr>
<td>Cognition</td>
<td>33.61</td>
<td>9.19</td>
<td>0.55</td>
<td>-0.11</td>
</tr>
<tr>
<td>Anxiety</td>
<td>148.50</td>
<td>30.51</td>
<td>-0.06</td>
<td>-0.96</td>
</tr>
</tbody>
</table>

3.1. Anxiety Predictors

For predicting anxiety, the proposed conceptual model was analyzed through the Path Analysis Method. For assessing the model, the Maximum Probability Method was employed. For measuring the model’s fitness, K Square Index on the level of latitude, Comparative Fitness Index (CFI), Conformity Fitness Index (GFI), Adjusted Conformity Fitness Index (AGFI) and, Square of Mean Error of Estimate Squares (RMSEA).

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery Goals</td>
<td>1</td>
<td>-0/55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance-approach</td>
<td>-0/58</td>
<td>0/62</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Performance-avoidance</td>
<td>-0/38</td>
<td>-0/39</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic</td>
<td>0/51</td>
<td>-0/38</td>
<td>-0/39</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extrinsic</td>
<td>0/46</td>
<td>0/41</td>
<td>-0/14</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amotivation</td>
<td>-0/49</td>
<td>0/36</td>
<td>0/31</td>
<td>-0/50</td>
<td>0/22</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta-cognitive</td>
<td>-0/36</td>
<td>-0/38</td>
<td>0/54</td>
<td>-0/30</td>
<td>-0/40</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognition</td>
<td>-0/35</td>
<td>0/41</td>
<td>0/46</td>
<td>-0/29</td>
<td>0/49</td>
<td>0/30</td>
<td>-0/39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Statistics Anxiety</td>
<td>-0/51</td>
<td>0/35</td>
<td>0/39</td>
<td>-0/48</td>
<td>0/36</td>
<td>0/49</td>
<td>-0/52</td>
<td>0/49</td>
<td>1</td>
</tr>
</tbody>
</table>

3.2. Indirect (Side) and Total Effects

Based on the path analysis, the indirect effect of mastery goals on meta-cognitive strategies through the intrinsic motivation (0.20) and the indirect effect of mastery goals on statistics anxiety (-0.26) is at significant level of (p<0.01). Thus the motivational mediation role of intrinsic motivation, meta-cognitive strategies, and a-motivation among the mastery goals and anxiety is confirmed.

<table>
<thead>
<tr>
<th>AGFI</th>
<th>GFI</th>
<th>CFI</th>
<th>RMSEA</th>
<th>x/df</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/92</td>
<td>0/98</td>
<td>0/99</td>
<td>0/07</td>
<td>2/72</td>
</tr>
</tbody>
</table>

*P<0/05, **P<0/01
The indirect effect of performance-approach goals on the meta-cognitive strategies through the extrinsic motivation (0.12) and the indirect effect of performance-approach goals on statistics anxiety (0.08) is at positive and significant level of $p<0.01$. Given that the indirect effect of performance-approach goals on statistics anxiety is done through extrinsic motivation and cognitive strategies, one can say that extrinsic motivation and cognitive strategies play a mediation role between performance-approach goals and statistics anxiety.

Table 4. Indirect Effects in Path Analysis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Indirect Effects</th>
<th>Variables</th>
<th>Indirect Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>mastery goals effects on meta-cognitive strategies</td>
<td>0.20**</td>
<td>Performance-avoidance effects on cognitive strategies</td>
<td>0.07*</td>
</tr>
<tr>
<td>mastery goals effects on anxiety</td>
<td>-0.26*</td>
<td>Performance-avoidance effects on anxiety</td>
<td>0.10**</td>
</tr>
<tr>
<td>Performance-approach effects on cognitive strategies</td>
<td>0.12**</td>
<td>intrinsic motivation effects on anxiety</td>
<td>-0.07*</td>
</tr>
<tr>
<td>Performance-approach effects on anxiety</td>
<td>0.09**</td>
<td>extrinsic motivation effects on anxiety</td>
<td>0.09**</td>
</tr>
</tbody>
</table>

4. Conclusion

In this study the effect of achievement goals, academic motivation, and learning strategies on statistics anxiety was analyzed. Path analysis confirmed this hypothesis of ours that students' goal orientation, academic motivation, and learning strategies can affect students' level of anxiety in statistics. As the research findings indicate, mastery goals as well as performance-approach goals have a direct and significant effect on statistics anxiety, but performance-avoidance goals affect statistics anxiety only through extrinsic motivation, a-motivation, and cognitive strategies. All in all achievement goals, academic motivation, and learning strategies can explain only 0.46 percent of the statistics anxiety changes. Based on the findings, performance-approach goals have direct negative weak (but) significant effect on statistics anxiety and this is not consistent with most of the researches' findings of Stipek and Kavalski (1989) and Elliot and church (1997). This might be resulted from a dual combination of performance-approach goals from the models and positive-negative results over which there is not much consistency among the researcher's findings.

Findings show that performance-avoidance goals have no direct relationship with statistics anxiety; rather they affect statistics anxiety through cognitive strategies and extrinsic motivation. The findings of this study indicate the
relationship between achievement goals and academic motivation and confirm the correlation between individuals' goal orientation and the level of their self-determination. Mastery goals have a positive significant relationship with intrinsic motivation and a negative significant one with a-motivation and explain %26 and %24 of their changes respectively. Also performance-approach goals as well as performance-avoidance goals have a significant relationship with extrinsic motivation and explain %23 of their changes.

Generally the findings of this study were consistent with other suggested models (Green and Miller, 1996; Moneta and Spada, 2009; and Putwain and Daniels, 2010) and emphasize on goal orientation, academic motivation, and learning strategies in explaining anxiety changes in a specific context (statistics).

References