Predicting Academic Performance of Medical Students in Iran University of Medical Sciences based on Martin Ford's Theory of Incentive Systems

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Abstract

Background: academic performance as the basis for judging students' knowledge ans skills in a specific period is based on the education development program. We aimed to predict the performance of medical students based on the Martin Ford motivational systems theory.

Methods: This study was a cross-sectional study on 170 medical students in science education, training and internship at Iran University of Medical Science, who were selected through random sampling. Motivational Strategies for Learning Questionnaire (MSLQ) was completed by all participants. Grade point average (GPA) was selected as academic performance. Pearson's correlation and stepwise regression were used for data analysis.

Results: There was a moderate relationship between responsive environment and academic performance ($R=0.43$, $P<0.001$), determined 19 percent ($R^2=0.191$, $P<0.001$). Considering the regression coefficient of the predictor variable, the weight of responsive environment ($B=0.662$) indicates that the variable could predict the changes related to the students' academic performance. So, the weight of responsive environment would be in a more conservative state in generalizing the sample group to the statistical population.

Conclusion: For predicting academic performance, responsive environment should be considered as hidden curriculum and educational planner should pay more attention to it.

Keywords: PREDICTION, ACADEMIC PERFORMANCE, MARTIN FORD MOTIVATIONAL SYSTEMS THEORY

Introduction

Academic performance at universities has always been the leaders' and researchers' focus of attention. What factors affect the academic progress and achievement of students and/or the extent to which each factor is contributed in academic performance has always been questioned (1, 2). McDonald stated that improvement in the quality of universities has a direct relationship with students' academic performance (3). Further, Lindemann and co-workers stated that academic performance as

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the basis for judging on the gained utilities by students in a specific period has centered on education development programs (4). To predict the academic performance, researchers believe that determining effective related criteria and variables is very important. By detecting variables affecting academic performance, there will be the possibility to improve variables to attain the best performance. Many studies have been done to predict academic performance. Noe and colleagues found that performance derived from personal characteristics, skill, etc. (5). Kruck and co-workers in a research entitled "prediction of academic performance at the elementary level of college" deduced that motivation is effective in predicting the performance. They stated that academic talent was associated with academic performance (6). In another study on a model to describe the students' performance in a course of financial accounting at elementary college level, the previous experience of accounting in high school and college was known effective in performance (7). Cote and Levine who worked on attitude and talent deduced that motivation is a stronger predictor than the information measured from IQ score for success (8). Campbell co-workers at the University of Florida displayed that the theory of motivational systems was an authentic model for prediction of performance (9). Camara and colleagues stated that grade point average (GPA) was the best predictor for prediction of success in university (10). Samani and colleagues found that the extent of efficiency in scores of entrance exam predicted the students' academic performance in some fields of study in university of Shiraz (11). Homaei and co-workers mentioned the best predictors of students' academic performance with average grade point of diploma, sex and emotional intelligence and other variables including the motive to progress, cognitive intelligence, marital status, employment status, age, income and being native or not have not had a significant relationship with academic performance (12). Another study indicated that there was a significant relationship between high exam anxiety and students' academic performance (13). In one study, no significant relationship was found between anxiety and academic performance (14). In another study, no significant relationship was seen between exam anxiety and GPA and girl students with higher exam anxiety had higher GPAs (15). Other researchers stated that there was a positive significant relationship between variables of Time Study Environ, place for study, organizing effort, learning from classmates and getting help and academic achievement (16).

Motivational systems theory is a multifaceted model which has considered most of the factors affecting academic performance. To date, the validity of motivational systems theory has not been measured in predicting academic performance of medical students in Iran. Martin Ford proposed the motivational systems theory (17, 18). In this theory, motivation has been considered as a multifaceted process which is the result from a series of interactions between goals, emotions and beliefs. Martin Ford has proposed the motivational systems theory for relationship between motivation and success so as to mention three areas of human motivation: 1-selected process of behavioral patterns, 2-selected activation of behavioral patterns, 3-selected adjustment of behavioral patterns. In Martin Ford's motivational systems theory, motivation associates to three factors below (17).

Motivation=Goal*Emotion*Beliefs　　　(1)

In this model, the person's thoughts target the appropriateness or inappropriateness of the results to which he loves to achieve. Thus, the goal orientation is determined and the behavior now has a meaning. Martin Ford has put emphasis on personal goals, because the goal cannot be imposed on a person (17). The person's beliefs are grounded on whether he has the required abilities to achieve the goal and whether he has put effort to support it (17, 18). The emotions mean why people try to do or adjust something (9, 17). With regard to the

emphasis of motivational processes on the person, Martin Ford displayed two concepts of success and competence for the effective performance. He stated that success implies access to social or value goal and competence implies access to the goals related to specific environments. Martin Ford by understanding the elements which make the performance effective knew four preconditions including motivation, skill, biological variables and responsive environment required for success (17).

$$performance = \frac{skill * motivation}{biological\ variables} * responsive\ environment \quad (2)$$

With regard to this formula, effective performance does not take place without a motivated person who has the required skill and biological abilities for constructive interaction with an environment which has the required resources to facilitate access to goal (19). Skill refers to previous knowledge and abilities of the studies such as the previous knowledge of person and its effect on learning, proper study and habits. Biological variables associate to the emotional area which is measured via exam anxiety. Responsive environment implies the collaboration of student with his classmates, tendency to help and get help, the ability to Time Study Environ and the environment for studying and organizing effort (9).

Methods

This study was a cross-sectional study which was conducted via stepwise regression and correlation. The statistical population consisted of 170 girl and boy students who were studying in the field of general medicine during 2013-2014. The required information was obtained through the Pintrich motivational strategies for learning questionnaire (20). This questionnaire has a wide application worldwide, localized in many countries and used for different purposes including determination of self-adjustment strategies and prediction of students' performance as stated by the author. Arabzade (2008) proved the reliability of this questionnaire (21). Value of Cronbach's alpha

in the mentioned research was 0.66-0.68. This questionnaire consists of 81 questions, 49 of which were used considering the goal of research. Pintrich reported the reliability coefficient for the cognition strategies of repetition and exercise (0.69), extension (0.76), organizing (0.64), meta-cognitive strategies (0.79), Time Study Environ and environment (0.76), effort (0.69), search for help (0.52), motivational strategies (self-efficacy) (0.93). For content validity of questionnaire, the questionnaire together with the original text was given to one of the professors of English department to evaluate the questionnaire after translating and preparing it to examine the conceptual relationship between terms and subject of questionnaire and ability of each term in measuring the subject. After confirming the consistency of translation of Persian text with the English text, the questionnaire was examined and modified by the evaluator professors. Then the preliminary execution to examine the students' understanding from terms and modifying the difficult terms was made. At this stage, the students faced problems in understanding some items and terms, and these items were revised again and then the questionnaire was performed on a number of students and the students were asked to specify if a term is ambiguous to them. At the end, after partial changes, the final version of the questionnaire was prepared for performing it. Further, the students mark the extent of their ability in each item with a 7-point scale ranging from 1 to 7. To estimate reliability, Cronbach's alpha was used and the questionnaire was performed on a sample [30]. The reliability coefficient was obtained equal to 0.89, 0.85, 0.74 and 0.78 for total questionnaire, cognitive strategies, metacognitive strategies and resources management strategies, respectively. Variable of skill was measured via average grade point of diploma and other variables were determined in this way:

● **Motivational component:** Intrinsic Goal Orientation (4 questions), Extrinsic Goal Orientation (4 questions), task value

(6 questions), Control Learning Beliefs (4 questions) and self-efficacy (7 questions).

● **Biological component:** test anxiety (5 questions)

● **Responsive environment:** Time Study Environ (8 questions), Effort Regulation (4 questions), Peer Learning (3 questions), Help seeking (4 questions).

In addition to questions above, filling the demographic characteristics (sex and semester), total average grade point of previous semester and the average grade point of diploma were required for data analysis. The collected data were analyzed via software SPSS and the results were proposed in two parts of descriptive and inferential statistics.

Results

The individuals in sample group consisted of 170 general medical students consisting of woman [90], man [80], basic sciences [42], training [73], Internship [55]. Among components of Martin Ford's motivational systems theory, there is a medium relationship between responsive environment and academic performance (R=0.43   Pvalue?), determined 19% (R^2=0.191   Pvalue?). further, with regard to the regression coefficient of the predictor variable, the weight of responsive environment (B=0.662) indicates that the variable can predict the changes related to the students' academic performance which the weight of

responsive environment will be in a more conservative state in generalizing the sample group to the statistical population(Table 1).

$$Academic\ performance = 13.214 + (0.437)(responsive\ environment) \quad (3)$$

Among sub-scales related to responsive environment, Time Study Environ (B=0.332, P>0.005) and organizing effort (B=0.264, P>0.005) can determine the changes related to the academic performance. These two sub-scales determine 19% of the academic performance variance (Table 2).

$$Academic\ performance = 13.397 + (0.267)\ Time\ Study\ Environ + (0.231)\ organizing\ effort \quad (4)$$

Discussion

Predicting students' academic performance based on Marin Ford's motivational systems theory has been one of the goals of this research. Results from regression indices indicate that responsive environment among the components of Martin Ford's motivational systems theory is the only predictor for academic performance in students; among sub-scales of responsive environment, Time Study Environ and organizing effort are the best determinants for academic performance. These results are consistent with the study by Paulsen and coworkers (16). Time Study Environ implies that the students should manage their study time and environment. Time Study Environ includes planning and Time Environ for a study. Organizing effort refers to a self-management strategy which

Table 1: Regression indices for components of Martin Ford's motivational systems theory on academic performance

Regression model index	B	SEB	Beta	t	Sig
Fixed	13.214	0.444		29.790	0.001
Responsive environment	0.662	0.105	0.437	6.0	0.001

Notification: R^2_{adj}=0.186; R^2=0.19; R=0.437; F=39.656

Table 2: Regression indices for sub-scales of responsive environment on academic performance

Regression model index	B	SEB	Beta	t	Sig
Fixed value	13.397	0.412		32.431	0.001
Time Study Environ	0.332	0.108	0.267	3.07	0.002
Organizing effort	0.264	0.099	0.231	2.659	0.005

Notification: R^2_{adj}=0.189; R^2=0.199; R=0.44; F=20.712

states that the person continues working till completing a task or not. Organizing effort is of great importance in academic achievement because it displays the continuity of effort and use of learning strategies. With regard to high correlation between motivation and responsive environment, the component of motivation has excluded from analysis in stepwise regression, but Pearson correlation indicates that there is a significant relationship between motivation and academic performance. It is obvious that many variables might have a significant relationship with academic performance in *univariate* analyses, but when those variables are analyzed, most of the predictor variables due to internal correlation with each other are removed in group analysis. Concerning the responsive environment, Walker and Greene supported the value of responsive environment under the presumption that students and environment are the factors related to each other which result in deeper understanding of students' motivation and achievement of goals (22). Eccles and Midgley stated that the student's positive interaction with teacher and the relationships which take place in a responsive environment increase motivation and beliefs about success (23). Goodenow (1993), Osterman (2000), and Voelkl (1996-1997) perceived that the schools will support and foster the students' perceptions and increase students' success and interaction by means of establishing a comprehensive environment (19). The component of skill which has been measured via GPA of diploma has not a significant relationship with academic performance, which is not consistent with the results from study by Homaei and colleagues (12), Samani and Jowkar (11). One of the features of variance analysis and statistical indices lies on this fact that the fixed values in analysis are excluded from the study. In the present research, 95% of the students have GPA above 19 which this is due to the fact that most of the individuals which are accepted in the medical field and university type 1 are among the top individuals accepted in entrance exam and are

considered among the fixed values in analysis due to the closeness of their diploma GPA. In this study, there was no significant relationship between biological factors and academic performance which this is inconsistent with the study by Yazdani, Soleimani (24) and results of study by Vitasari and coworkers (13). Yet, it is consistent with the results from study by Cheraghian (14) and Chapell (15). With regard to Martin Ford's motivational systems theory, variable of biological factors is in the denominator, i.e. there is an indirect relationship between performance and biological factors. In this study, as the biological factors have been measured via 5 questions related to exam anxiety, there is less possibility to span biological factors by these five questions, suggested that this item is measured via other methods including Mandler-*Sarason Test Anxiety* Questionnaire. Further, as stated by Mark and Chappell, female students with higher exam anxiety had greater GPA. The contrast in responses can be attributed to the difference between anxiety and positive and negative loading (15). Pintrich has mentioned three components of cognitive, meta-cognitive and resources management strategies for self-regulation (20). In this study, component of responsive environment has been measured via resources management. Resources management, as part of the self-regulation learning strategies results in students' independent activity in learning; self-regulated students apply their behavioral and cognitive actions to achieve their goals (24). The learners' motivation to achieve their goal has derived from a judgment on their self-regulated performance. Self-regulation results in better learning and rise of self-efficacy in learners (25). Pintrich stated the self-regulated learners start their work with an educational work, engage in evaluating their work, set their goal and specify the strategies to achieve their goals, monitor their progress to achieve goal, evaluate the strategies and monitor the work based on the information from the internal and external feedbacks of

work (25). Professors and academic planners are the most important group to create a suitable learning environment, that they can assist for students' academic achievement and encourage them to foster in the society by training resources management strategies to the students and making an intimate relationship with them. Further with regard to large contribution of responsive environment in prediction of performance, it can be a hidden curriculum which can make relationship with content of course, professor's assignments and evaluation scores.

Since this study was limited to the students in the field of general medicine which is the same in some components including skill which was measured via their GPA, an attempt is made to conduct this research in other fields of study. Further, it is suggested to study other variables including cognitive and meta-cognitive strategies which affect the academic performance.

Conclusion

With regard to large contribution of responsive environment in prediction of performance, it can be a hidden curriculum which can make relationship with content of course, professor's assignments and evaluation scores. Professors and academic planners are the most important group to create a suitable learning environment, that they can assist for students' academic achievement and encourage them to foster in the society by training resources management strategies to the students and making an intimate relationship with them.

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Conflict of Interest

The author declares no conflict of interest.

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