The relationship between critical thinking, epistemological beliefs, and learning strategies with the students' academic performance

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Abstract

The present study was conducted to investigate the relationship between critical thinking, epistemological beliefs, and learning strategies with the academic performance of high school first-grade male and female students in Yazd. For this purpose, from among all first-grade students, as many as 250 students (130 females and 120 males) were selected by using multistage cluster sampling. The data needed were then collected through using California Critical Thinking Skills Test, Schommer's Epistemological Beliefs Questionnaire, Biggs' Revised Two Factor Study Process Questionnaire. The findings indicated that there is a positive significant relationship between critical thinking and academic performance and achievement. Moreover, four factors of epistemological beliefs include knowledge structure, knowledge stability, learning ability, and learning speed; these four factors have a positive significant relationship with the students' academic performance. The other variable of the present study is learning strategies including deep and surface strategies. The findings of the present study indicated that there is a positive significant relationship between deep learning strategy and academic achievement. However, no significant relationship was observed between surface learning strategy and academic performance. Furthermore, the findings obtained from the multiple regression analysis indicated that except for the surface learning strategy, all other predictor variables (i.e. critical thinking, structure, stability, ability, speed, and deep learning strategy) explained and predicted the academic performance. To sum up,

it can be claimed that critical thinking, epistemological beliefs, and deep learning strategy affect the students' academic progress and achievement.

Key words: critical thinking, epistemological beliefs (knowledge structure, knowledge stability, learning ability, and learning speed), learning strategies (deep/surface), students' academic performance

1. Introduction

Every study is basically seeking ways for the growth, development, and progress of that society. When a society aims to achieve the growth and development intended, it needs to take into account all the related variables. One of the progress estimation of a society is estimating the progress of its individuals. One of the common methods of determining the progress of individuals is estimating the theirs progress in terms of different performances including the academic performance (Farooq et al, 2011; Cano, 2005).

Nowadays, on the path to the growth and development of societies, one of the main problems and obstacles of the educational systems is the students' academic failure that brings about wasted financial and human resources as well as inefficient educational system (Farooq et al, 2011). The efficiency and capability of the educational system of a country indicates the growth and development of that country. Glancing over the developed countries, one can realize that their flourishing and development coincides with their developed and dynamic educational system (Martin et al, 2006). For this reason, academic performance and the factors that are likely to affect it have long been of great significance for the psychologists as well as educational instructors as one of the indices of successful scientific activities. Giving due attention to academic performance is on top of educational development programs.

Numerous factors affect the academic performance of students of both schools and colleges. These factors are commonly divided into two groups: external factors (including family, school, and society) and individual factors (including intelligence, cognitive abilities, personality, motivation, self-efficacy, critical thinking, learning strategies, epistemological beliefs, etc.) (Farooq et al, 2011; Mlambo, 2011; Martin et al, 2006). Over the recent years, the individual factors have been of greater interest and significance for the researchers (Kuper et al, 2007). The important individual factors include critical thinking, learning strategies, and epistemological beliefs.

Students who have developed and applied critical thinking are able to think independently and identify their own limitations. Moreover, they understand the course materials much better and much more effectively, and they manage to acquire higher scores from the tests. The aforementioned factors will result in improved academic performance (Santrock, 2011; Lipman, 2003). Theoretical approaches as well as most of the experimental studies highlight the effect of critical thinking on the students' improved academic performance (Phan, 2010; Facione, 2011; Santrock, 2011).

The students' learning strategies are also included as the important variables affecting their academic performance. Learning strategy is a method the learners apply in learning the course materials based on the understanding they have from the learning concept; the learners prefer this method to the other ones (Bakhshayesh, 2015). The studies conducted in this regard have indicated that deep learning strategy has a positive significant relationship with improved academic performance. However, there is no significant relationship between surface learning strategy and academic performance (Bakhshayesh, 2015; Rezaei et al, 2014; Wickramasinghe & Samarasekera, 2011).

Thus, progress in of the academic performance is likely to predict the progress of other levels of performance (Martin et al, 2006). Therefore, the phenomena are linked to one another as circles of a chain in the studies conducted in humanities and social sciences and investigating the academic performance is no exception. As all of the variables related to the academic performance cannot be investigated in a single study, the present study aims to investigate the relationship between critical thinking, epistemological beliefs, and learning strategies with academic performance.

2. Research method

Since the present study investigates the relationship between several predictor variables and the criterion variable, the method applied for the present study is a correlational one. Therefore, in the present study, the academic performance is the criterion variable, and the predictor variables include critical thinking, epistemological beliefs (simple/complicated, absolute/relative, innate/acquired, fast/gradual), and learning strategies (surface/dee).

2.1 Statistical population and sample group

The statistical population of the present study includes all female (2810) and male (2465) high school first-grade students of the public schools of Yazd. From this statistical population, a sample group including 250 students (130 females and 120 males) were selected. The number of this sample group was selected based on Morgan's table for sample size as well as the suggested formulas for determining the number of sample group's participants (provided in statistical books including Delavar's *Statistical Arguments*). The sample participants were selected by using multistage cluster sampling. The participants were selected randomly; from among all of the female and male public schools, 15 high schools (8 female high school and 7 male high schools). Then, a first-grade class was

randomly selected from each school, and the selected participants were then randomly selected from each class.

2.2 Research tools

2.2.1 California Critical Thinking Skills Test (CCTST)

This test was designed by Facione to measure critical thinking skill from the high school level (Hare and McGuinness, 2009). This test has 34 four-or-five-choice questions with one correct response (1 point). In other words, each question has one correct answer, and if the students respond correctly, they obtain 1 point. The score the examinees obtain from the entire questionnaire is considered as his/her total score of critical thinking (maximum score of 34 points) (Bakhshi and Ahanchian, 2014). For rating the items, the scores of critical thinking are divided into four categories: weak (1-8); intermediate (8-16); good (16-24); and excellent (more than 24). The validity of this test has been confirmed by the specialists (Hare and McGuinness, 2009).

2.2.2 Schommer's Epistemological Beliefs Questionnaire (SEBQ)

This questionnaire was designed by Schommer to measure the epistemological beliefs as a multidimensional construct having 63 items on a five-point Likert scale ranging from completely disagree (1) to completely agree (5) (Cano, 2005; Barten, 2005).

2.2.3 Revised Two Factor Study Process Questionnaire (R-SPQ-2F)

This questionnaire is the revised version of Biggs's Study Process Questionnaire (1987) developed by Biggs, Kember, and Leung (2001) to measure two learning strategies i.e. surface and deep.

2.3 Data analysis

For conducting the statistical analysis of the data obtained from the present study, the descriptive statistical methods such as mean, standard deviation, and

inferential tests including Pearson's correlation and multiple regression were applied. Pearson's Correlation matrix test was used to determine the relationship between the variables, and multiple regression was applied to investigate the relative ration of predictor variables in predicting the criterion variable.

3. Research findings

3.1 The quantitative description of variables

The information provided in table 1 indicate the distribution of the examinees' scores in terms of critical thinking, deep/surface learning strategies, academic performance, and epistemological beliefs of structure (complexity), stability (relativity), ability (acquisitiveness), speed (gradualness) based on different descriptive indices including mean, standard deviation, and minimum/maximum score. The findings indicated that the indices of skewness and Kurtosis of the variables are within ±2; this indicates that variables are of a desired status for conducting parametric analyses.

Table 1. Summary of descriptive indices of the participants' scores in terms of the research variables (N=250)

Variable	Components	Mean	Standard Deviation	Skewness	Kurtosis	Minimum Score	Maximum Score
Critical thinking	-	22.97	8.87	0.2	-1.32	10	٣٦
Learning strategy	Surface	23.17	9.74	1.1	-0.026	١٣	٥٤
	Deep	26.86	9.63	0.293	-1.47	١٤	٤٢
Epistemological beliefs	Structure (complexity)	40.65	13.48	0.09	-1.08	١٥	٦٣
	Stability (relativity)	40.75	15.01	0.01	-1.52	١٧	٦٢
	Ability (acquisitiveness)	39.48	15.94	0.11	-1.23	١٦	٦٣
	Speed (gradualness)	39.63	14.54	-0.052	-1.23	١٦	٦٢
Academic performance	-	15.95	2.04	0.22	-1.41	12.75	19.5

Table 2 indicates the results of correlation matrix of research variables. The relationship between academic performance and structure (complexity) (r=0.742, P<0.01), academic performance and critical thinking (r=0.588, P<0.01), and academic performance and learning strategies (r=0.582, P<0.01) were positive and significant. However, no significant relationship was observed between academic performance and surface learning strategies (r=-0.05, P>0.05).

The relationship between academic performance with stability (relativity), ability (acquisitiveness), and speed (gradualness) (r=0.702, P<0.01), academic performance and critical thinking (r=0.57, P<0.01), and academic performance and deep learning strategies (r=0.591, P<0.01) were positive and significant. However, no significant relationship was observed between academic performance and surface learning strategies (r=0.07, P>0.05).

Table 2. Correlation matrix of the variables

Variable	Component	1	2	3	4	5	6	7	8
Critical thinking	-	1							
Learning strategies	1. Surface	-0.11	1						
	2. Deep	0.677**	-0.088	1					
Epistemological beliefs	3. Structure (complexity)	0.588**	-0.05	0.582**	1				
	4. Stability (relativity)	0.57**	0.073	0.591**	0.674**	1			
	5. Ability (acquisitiveness)	0.652**	-0.035	0.618**	0.685**	0.71**	1		
	6. Speed (gradualness)	0.645**	-0.105	0.61**	0.656**	0.645**	0.815**	1	
Academic performance	-	0.737**	-0.092	0.701**	0.742**	0.702**	0.758**	0.742**	1

The findings indicated that the relationships between critical thinking with deep learning strategies (r=0.677, P<0.01) as well as critical thinking and academic performance (r=0.737, P<0.01) were positive and significant. However, no significant relationship was observed between surface learning strategies and critical thinking (r=-0.11, P>0.05).

The relationship between deep learning strategies and academic performance was positive and significant (r=0.701, P<0.01). However, the relationship between surface learning strategies and academic performance was not significant (r=-0.092, P>0.05).

Table 3 indicates that through referring to t statistic and levels of significance, one can conclude that critical thinking ($\beta=0.224$, t=4.729, p<0.01), deep learning strategies ($\beta=0.164$, t=3.57, p<0.01), and epistemological beliefs components including structure ($\beta=0.245$, t=5.185, p<0.01), stability ($\beta=0.1$, t=2.013, p<0.01), ability ($\beta=0.158$, t=2.599, p<0.01), and speed ($\beta=0.147$, t=2.598, p<0.01) have positive significant effect on the academic performance. However, surface learning strategies have no significant effect on the academic performance ($\beta=0.224$, t=4.729, p>0.05).

Table 3. Summary of predictor regression coefficients (N=250)

Predictors	Unstandardized coefficients	Standard error	Dependent variable: academic performance Standardized error	t	P
Critical thinking	٠.٠٥٨	٠.٠١٢	٠.٢٢٤	٤.٧٢٩	٠.٠٠٠
Structure	٠.٠٣٧	٠.٠٠٧	٠.٢٤٥	٥.١٨٥	٠.٠٠٠
Stability	٠.٠١٤	٠.٠٠٧	٠.١	٢.٠١٣	٠.٠٤٥
Ability	٠.٠٢	٠.٠٠٨	٠.١٥٨	٢.٥٩٩	٠.٠١
Speed	٠.٠٢١	٠.٠٠٨	٠.١٤٧	٢.٥٩٨	٠.٠١
Surface strategies	−٠.٠٠٧	٠.٠٠٧	−٠.٠٣٤	−١.٠٦٥	٠.٢٨
Deep strategies	٠٣٥	٠.٠١	٠.١٦٤	٣.٥٧	٠.٠٠٠

4. Discussion

The findings of the present study indicated that there is a positive significant relationship the students' (female and male) critical thinking and academic performance. This means that the higher the students' critical thinking, the better their academic performance will be. Moreover, the lower their critical thinking, the poorer their academic performance will be. Anderson et al (2001) maintain that the factors of critical thinking including criticism, evaluation, deduction, reasoning, student-student communication, student-teacher communication, and activeness, etc. affect the improved academic performance of the students. It seems that students who have developed and applied critical thinking are able to think independently and identify their own limitations. Moreover, they understand the course materials much better and much more effectively, and they manage to acquire higher scores from the tests. The aforementioned factors will result in improved academic performance (Santrock, 2011). Critical students are actively involved in the learning process, and they have a purposeful attitude towards learning. Critical students attempt to analyze and evaluate the materials throughout learning the course materials, and they hardly ever make judgments about the materials without analyzing and evaluating them. Interpreting and analyzing the course materials as well as their active involvement and purposefulness result in their improved learning and academic performance (Fascione, 2011).

There is a positive and significant relationship between epistemological beliefs (structure, stability, ability, and speed) and academic performance. In other words, the students' beliefs in the complexity, relativity, acquisitiveness, and gradualness of learning will result in their improved academic performance.

However, the students' beliefs in the simplicity, innateness, and fastness of learning will result in their poor academic performance.

The component of stability (one of the epistemological beliefs components) means the individual's belief in either the absoluteness and errorless nature of knowledge or its relativity and the likelihood of error and mistake. The belief in the relativity of knowledge is associated with better academic performance and achievement. However, the belief in the absoluteness of knowledge has to do with poor academic performance (Schommer, 2004). Students who believe that knowledge is not absolute have a more positive attitude towards knowledge; it is consistent with the environmental conditions as well as the conditions of the individuals themselves. These students maintain that the passing of time will question the correctness of a piece of knowledge about a specific subject; both science and knowledge are increasing developing, and the individuals are in need of updating their knowledge. This calls for studying more, conducting various tests on the subjects, and searching for new information on the subjects involved; this will result in improved academic performance and achievement (Schommer, 2011; Hofer and Pintrich, 1997). A student who believe that knowledge is not absolute always deals with the subjects with a critical attitude and viewpoint. Instead of merely memorizing the materials, critical students attempt to analyze the subjects deeply and critically when they deal with a specific subject. They identify the advantages and disadvantages of the problems and attempt to seek methods for solving the problems they deal with. This will not only result in their improved academic performance but also help them grow and develop knowledge (Conley, 2004). However, students who maintain that knowledge is absolute and unchangeable attempt to memorize the course materials; they believe that knowledge is

always correct and absolute, and they are therefore able to achieve their goals including obtaining pass marks through memorizing the course materials. Such students hardly ever have a critical and analytical attitude towards the problems and issues. In dealing with the change of knowledge and theories, they tend to resist and attempt to deal with all the issues through adopting the same attitude and method. These factors prevent them from updating their knowledge, having a deep understanding of the materials, and enjoying a critical and analytical attitude towards the course materials; they result in reduced academic performance and achievement (Schommer, 2001).

The component of speed (one of the epistemological beliefs) also deals with the issue that whether an individual believes that learning happens altogether and fast or it occurs step-by-step and gradually. A belief that maintains that learning is a continuous and gradual process needs to practice, organize, and develop the materials to achieve a deep and constant learning. In this process, the student needs more time to review the materials repeatedly and associate them with his previous knowledge and real-life situations; he maintains that learning is a continuous process, and for achieving a deep and constant learning, he needs to conduct these activities (Yilmaz and Topcu, 2010; Schommer, 2004). However, the belief of fast learning (a belief that learning happens over a short time) predicts simplified conclusions, rote memorization of the materials, and poor performance. The belief in fast learning leads to the false confidence the individual can learn a wide variety of materials over a short time. This brings about simple and cursory learning; learning is a complex process that calls for lots of attempt and hard work (Cano, 2005).

The other results of the present study indicated that there is a positive and significant relationship between deep learning strategy and academic

performance. However, there is no significant relationship between surface learning strategy and academic performance. Students who apply deep learning strategies will be excited about being satisfied with themselves and attempt to associate previous information with the information available to them. They are also interested in having a deep understanding of the materials they are going to learn. These kinds of students are interested in doing homework and they enjoy doing it. They attempt to learn the materials they study and understand their concepts through conducting experiments and experiences. They put the separate parts of knowledge to achieve a main concept. They associate the new information with their previous knowledge and attempt to have hypotheses about their homework (Biggs, 1987). Students who adopt surface learning strategies study the materials cursorily and by rote. They see the homework as a goal to achieve. They maintain that science is of discrete parts that are not related to one another. They feel anxious about time (Phan, 2010; Biggs, 1987). Adopting a surface or deep attitude towards learning affect the students' progress and motivation (Braten and Strøms, 2005; Cano, 2005). Moreover, in the present study from among the predictor variables, structure, critical thinking, deep learning strategy, ability, speed, and stability had the highest predicting power for the students' performance. However, the surface learning strategy did not manage to predict the students' academic performance.

5. Conclusion

In summary, it can be said that students who have developed and adopted critical thinking are able to think independently and identify their own limitations. Moreover, they understand the course materials much better and much more effectively, and they manage to acquire higher scores from the

tests. According to the findings of the present study, it can be said that in addition to the students critical thinking and their epistemological belief, their learning strategy affect their academic performance as well. Students that adopt a deep learning strategy are interested in doing homework and they actually enjoy doing it. It is hoped that teachers, managers, and all those involved with education pay due attention to the abovementioned factors in teaching and planning academic activities.

دراسة العلاقة بين التفكير الناقد والمعتقدات المعرفية واستراتيجيات التعلم مع الأداء الأكاديمي للطلاب

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تطرقت هذه الدراسة إلى العلاقة بين التفكير الناقد والمعتقدات المعرفية واستراتيجيات التعلم مع التحصيل الأكاديمي لطلاب وطالبات السنة الأولى للمدارس الثانوية في مدينة يزد.لهذا الغرض ، تم اختيار ٢٥٠ طالبًا بواقع (١٣٠ طالبة و ١٢٠ طالبا) باستخدام طريقة أخذ العينات العنقودية متعددة المراحل و تم جمع المعلومات المطلوبة بواسطة مقياس مهارات التفكير النقدي في ولاية كاليفورنيا ، و استبانة Schommer للإعتبارات المعرفية ، و استبانة Bigg المعدلة وثنائية الأبعاد للدراسة. تظهر النتائج أن هناك علاقة ذات دلالة إحصائية بين التفكير النقدي والإنجاز الأكاديمي و هناك ارتباط وثيق بين المعايير الأربعة للمباني الأبستمولوجية بما في ذلك البنية ، الاستقرار ، القدرة ، والسرعة و بين الإنجاز الأكاديمي للطلاب .المتغير الآخر كان استراتيجيات التعلم ، والتي تضمنت استراتيجيتين عميقتين وسطحيتين.أظهرت نتائج هذه الدراسة أن هناك علاقة إيجابية كبيرة بين استراتيجية التعلم العميق والإنجاز الأكاديمي ومع ذلك ، لم يتم العثور على علاقة ذات دلالة إحصائية بين التعلم الاستراتيجية السطحية والإنجاز الأكاديمي كما أظهرت نتائج الانحسارالمتعدد الوجوه أنه فيما عدا إستراتيجية التعلم السطحية ، فإن المتغيرات السابقة الأخرى (التفكير النقدي ، البنية ، الاستقرار ، القدرة ، السرعة ، وعمق التعلم) تفسر وتنبيء الأداء الأكاديمي.و باختصار يمكن أن يؤثر التفكير النقدي والمعتقدات المعرفية واستراتيجيات التعلم العميق على التحصيل الأكاديمي للطلاب.

الكلمات المفتاحية: التفكير الناقد ، المعتقدات المعرفية (الهيكل ، الاستقرار ، القدرة ، السرعة) ، استراتيجيات التعلم (عميق / سطحي) ، الإنجاز الأكاديمي للطلاب

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