

HOW ARE HIGH SCHOOL STUDENTS' EPISTEMOLOGICAL BELIEFS RELATED TO THEIR GOAL ORIENTATIONS?

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Abstract: Literature reveals that epistemological beliefs and goal orientations affect students' strategy use and learning in turn. When students set mastery goals they are expected to use more advance strategies such as elaboration and critical thinking and develop conceptual understanding. In order to support meaningful learning, the relationship between epistemological beliefs and goal orientations needed to be defined clearly. This study was conducted to examine the relationship between two sets of variables: epistemological belief (the belief that learning depends on effort, the belief that learning depends on ability, and the belief that truth can change) and goal orientation (performance approach, performance avoidance, mastery approach, and mastery avoidance). Epistemological beliefs were assessed with the Epistemological Belief Questionnaire while goal orientations were measured using the Goal Orientation Scale. The data were collected from 950 Turkish high school students participating chemistry classes. Results of canonical correlation analysis revealed one significant canonical variate pair ($R_c^2 = .37$). The beliefs that learning depends on effort and ability were associated with performance approach and mastery approach goals.

Keywords: Epistemological beliefs, 2 x 2 achievement goal framework, chemistry, science education, canonical correlation analysis

INTRODUCTION

The purpose of this study was to examine the relationship between Turkish high school students' epistemological beliefs and goal orientations in chemistry courses. Recent studies revealed that students' epistemological beliefs are effective while they are setting learning goals (Ozkal, Tekkaya, Cakiroglu, & Sungur, 2009; Chen & Pajares, 2010). Students' who possess more sophisticated epistemological beliefs tend to set mastery type of goals more frequently and expected to use self-regulatory strategies more effectively (Ozkal et al., 2009; Chen & Pajares, 2010).

Achievement Goal Theory

Achievement Goal Theory explains the reasons for learning. Initial studies were guided by dichotomous (mastery versus performance goals) (Pintrich & DeGroot, 1990) or trichotomous frameworks (mastery, performance-approach and performance-avoidance goals) (Elliot & Church, 1997). Recently, Elliot and McGregor (2001) proposed a 2 x 2 achievement goal framework: performance approach, performance avoidance, mastery approach, and mastery avoidance. They developed a new instrument reflecting four goal orientation types and found empirical evidence. Mastery approach goals emphasize mastering the task or learning the task for its own sake and use achievement standards such as progress in the task or deep understanding of the topic. Mastery avoidance goals were defined as avoiding misunderstanding or not learning and students set not being wrong as a standard for learning. On the other hand, performance approach goals focus on doing better than others in a task and getting better grades than others is more important for learners. Lastly, students setting

performance avoidance type of goals give importance to not looking stupid compared to others and not getting worse grades than them. Although the validity of 2 x 2 achievement goal framework is still discussed, a few studies are providing empirical support (Bartels & Magun-Jackson, 2009; Conroy & Elliot, 2004; Sungur & Senler, 2009). The present study was guided by the 2 x 2 achievement goal framework.

Epistemological Beliefs

Epistemology as a discipline tries to explain individuals' beliefs about the nature of knowledge and knowing. It is "an area of philosophy concerned with the nature and justification of human knowledge" (p.88, Hofer & Pintrich, 1997). The present study was guided by multidimensional models which suggest that epistemological beliefs are independent; in other words, students can hold more sophisticated beliefs in one dimension and more naïve beliefs in another (Schommer, 1990; Hammer & Elby, 2002). In addition, in this study students' epistemological beliefs were defined based on the dimensions in the Schommer's questionnaire (Schommer, 1990) which reflects students' beliefs about knowledge and learning.

The Relationship between Students' Epistemological Beliefs and Goal Orientations

Recently researchers have been sought for the relationship between students' epistemological beliefs and goal orientation types and tried to understand mediating factors in learning. Their attempts to understand whether students possessing different epistemological beliefs tended to set specific type of goals and revealed more condense models (Ozkal et al., 2009; Chen & Pajares, 2010). For example, Chen and Pajares (2010) found that students holding more sophisticated epistemological beliefs tended to set task (mastery) goals while students with naïve perspective tended to set performance goals. They also found that students' motivational goals orientations affected their science achievement indirectly through self-efficacy.

Lately the effect of students' epistemological beliefs and goal orientations on different learning outcomes such as strategy use and self-efficacy beliefs has been investigated in the literature. Students using mastery goals are believed to employ higher order learning strategies such as elaboration more frequently. In order to develop classroom environments that support conceptual understanding and in turn increase achievement, initially the relationship between epistemological beliefs and goal orientations should be understood.

Research Question

The following research question guided the study: How strongly are Turkish high school students' epistemological belief variables related to their goal orientation types for chemistry context?

METHODOLOGY

Subjects of the Study

Totally 950 high school students attending chemistry courses participated in the present study. Of 950 students, 356 students (187 females, 169 males) were ninth graders, 323 (173 females, 148 males, and two nonrespondents) were tenth graders, and 271 (157 females, 112 males, and two nonrespondents) were eleventh graders.

Instruments

The Epistemological Belief Questionnaire (EBQ) developed by Schommer (1990) and adapted to Turkish culture by Deryakulu and Buyukozturk (2002) was administered to students to measure their epistemological beliefs. The Turkish version of the scale, showed a three dimensional factor structure: the belief of learning depends on effort (mentioned as *effort* throughout this study), the belief of learning depends on ability (mentioned as *ability*), and the belief that truth can change (mentioned as *truth*). In the present study, Confirmatory Factor Analysis (CFA) using LISREL 8.30 for Windows (Jöreskog & Sörbom, 1993) revealed the fit indices (.069 for Root Mean Square Error of Approximation (RMSEA), .073 for the Standardized Root Mean Square Residual (SRMR), .69 for Non-Normed Fit Index (NNFI) and .72 for Comparative Fit Index (CFI) were within acceptable limits, except for NNFI and CFI (Kline, 1998). The Cronbach alpha coefficients ranged from .48 to .71. Although the reliability coefficients were low, these values were close to the values reported in the literature (Schommer, 1993; Deryakulu & Buyukozturk, 2002).

The Goal Orientation Scale developed by Elliot and McGregor (2001) and translated to Turkish culture by Senler and Sungur (2007) was administered to determine the type of goals students pursue while studying for chemistry course. The instrument included four subscales: mastery approach, mastery avoidance, performance approach, and performance avoidance. Confirmatory Factor Analysis (CFA) was performed to test factorial validity of the scale. Findings indicated a good model fit with the following fit indices: RMSEA = .079, SRMR = .059, CFI = .95, and NNFI = .93 (Kline, 1998). The Cronbach alpha coefficients were found between .68 and .76.

RESULTS

The means and standard deviations for each factor, and bivariate correlations between the variables in each variable set and between the variable sets were presented in Table 1. High values for the mean scores indicated that students possess more sophisticated epistemological beliefs use that goal orientation type more frequently.

Table 1

Means, standard deviations, and bivariate correlations among measured variables in two variable sets.

Subscale	1	2	3	4	5	6	7
1. Effort	1.00						
2. Unchanging Truth	-.19**	1.00					
3. Ability	.17**	.17**	1.00				
4. Performance approach	.19**	-.19**	-.02	1.00			
5. Performance avoidance	.03	-.22**	-.14**	.49**	1.00		
6. Mastery approach	.32**	-.13**	.18**	.33**	.10**	1.00	
7. Mastery avoidance	.05	-.17**	-.13**	.25**	.33**	.21**	1.00
Mean	3.92	2.83	3.53	3.72	3.24	4.19	3.21
Sta. Dev.	.39	.51	.66	.97	1.06	.80	.97

** . Correlation is significant at the .01 level (2-tailed).

The canonical correlation analysis (CCA) was conducted to test the relationship between two variable sets (epistemological belief and goal orientation variables). Results of CCA revealed three canonical variate pairs; however, only the first canonical variate pair was

found to be significant. The canonical correlation coefficient between two canonical variates was found to be .37 accounting for 14% of overlapping variance.

Table 2 summarizes the correlations, standardized canonical coefficients, canonical correlations, percentage of variance, and redundancies between epistemological belief and goal orientation variables for the first canonical variate pair. Explained variance by epistemological belief and by goal orientation were 29% and 39%, respectively. When the canonical loadings were examined, the values greater than .40 were accepted as meaningful (Weiss, 1972). Effort and ability positively correlated with the first canonical variate while only the approach type of goals made significant contribution to the second canonical variate. Effort accounted for the highest percentage of variance with a loading of .90, whereas mastery approach goals has the highest with a value of $r=.95$. Truth and avoidance type goals did not have any significant contribution. On the other hand, the amount of variance in the canonical variate explained by the other canonical variate (called the redundancy index) was 4% for the epistemological belief and 6% for the goal orientation.

Table 2

Correlations, standardized canonical coefficients, canonical correlations, percentage of variance and redundancies between epistemological belief and goal orientation variables

	First Canonical Variate	
	Correlations	Coefficients
Epistemological beliefs variables		
Effort	0.90	0.78
Unchanging Truth	-0.30	-0.22
Ability	0.53	0.44
Percentage of variance	0.29	
Redundancy	0.04	
Goal orientation variables		
Performance approach	0.49	0.31
Performance avoidance	0.03	-0.16
Mastery approach	0.95	0.90
Mastery avoidance	0.04	-0.17
Percentage of variance	0.39	
Redundancy	0.06	
Canonical correlation	0.37	

DISCUSSION AND IMPLICATIONS

In this study, the relationship between Turkish high school students' epistemological beliefs and goal orientations was investigated. The results revealed that the canonical correlation between two variable sets accounted for 14% of the overlapping variance. In addition, the goal orientation variate accounted for higher variance (39%) than the epistemological belief variate (29 %). The beliefs that learning depends on effort and ability were associated with performance approach and mastery approach goals. This indicated that students who possessed more sophisticated epistemological beliefs, set approach type of goals more frequently while studying for chemistry course. Accordingly, explicit instruction of nature of science can help students develop more sophisticated beliefs and increase chemistry achievement in turn.

Mastery approach goals found to be explaining the highest variance of the canonical variate goal orientation with a canonical correlation value of $r=.95$. This result is parallel with the previous studies (Ozkal et al., 2009; Chen & Pajares, 2010). However, performance approach goals were also found to be positively correlated to epistemological beliefs which mean that students holding more sophisticated epistemological beliefs tend to set these goals as well as mastery goals. In Turkey, students are required to take nationwide exams in transition to a higher education level. Taking high scores from these exams are important to attend high reputation schools. Therefore, students might set performance goals for themselves to be more successful than other students.

This study has implications for educators and future research. Teachers should emphasize meaningful learning and help students develop sophisticated epistemological views. This study focused more on the relations between two variable sets in chemistry course for high school students in Turkish context. In the further studies, structural equation models can be employed to test the direct and indirect paths between these variables, and their relationship to academic achievement.

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