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An Evaluation of the Pattern between Students' Motivation, Learning Strategies and Their Epistemological Beliefs: The Mediator Role of Motivation

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ABSTRACT: This study aims at analysing the relations between students' achievement motivation, learning strategies and their epistemological beliefs in learning through structural equation modelling, and at exploring the mediation role of motivation in the relations between learning strategies and epistemological beliefs. The study group was composed of 446 undergraduate students attending the Faculty of Education. The Motivated Strategies for Learning Questionnaire (MSLQ) in addition to the Epistemological Belief Scale was employed as the instrument of data collection in the research. The data obtained were then analysed via confirmatory factor analysis and the path analysis. In consequence, it was found that the model consisting of such variables as learning strategies, motivation and the belief that learning depends on effort yielded the acceptable fit indices, and it was also found that motivation variable mediated between the relations holding between the belief that learning depends on effort and the learning strategies.

KEY WORDS: Motivation, learning strategies, epistemological beliefs, mediation, path model

INTRODUCTION

An effective process of learning is a process, which is accountable with the traits of the learner, the quality of the teaching process, the learning environment and the design of teaching. As is commonly known, teaching design and the learning environment are constructed by taking the properties of the learner into consideration. Psycho-educational structures are frequently considered in educational research as the properties intrinsic to the learner. However, on considering the inter-relations existing within those psycho-educational structures, a nomological network is established (Cronbach & Meehl, 1955). While the psycho-educational structures consist of high-level mutual relations, the mediator variables sometimes play important roles in this pattern. Determining those mediator variables gives significant clues in constructing the

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learning process and the design of teaching. Motivation, epistemological belief and learning strategies-which are among the important properties of the learner-, are within the scope of this current research. Besides, these are also the variables, which play important roles in learner-centred approaches. Students with high levels of epistemological belief concept will be more successful in using the learning strategies capable of influencing the learning process and in motivating themselves into learning. In addition to the direct effects of epistemological beliefs on learning strategies, these epistemological beliefs will also result in the positive development of learning strategies which are indeed the behaviours and thoughts arising in learning and facilitating learning with the increase of motivation due to students' sophisticated epistemological beliefs. In this case, describing the variable that motivation mediates in addition to describing the main effects of motivation on achievement is also important. This study examines the ties between students' epistemological belief, their motivation and their learning strategies; and additionally, it also investigates whether or not the effects of motivation on learning strategies are mediator or not.

Epistemological Beliefs

Epistemological beliefs, which are personal traits, are the beliefs that individuals have in relation to the nature of knowledge and to acquiring the knowledge (Schommer, 1990; 1994). According to Hofer (2001), epistemological beliefs involve beliefs about the definition of knowledge, how knowledge is constructed, how knowledge is evaluated, where knowledge resides, and how knowing occurs. Epistemological beliefs, which might be considered to be altogether, also form a five-dimensional system of beliefs containing such dimensions as the source of knowledge, organisation or structure of knowledge, stability of knowledge, speed of learning and control of learning; which might be considered independent of one another (Shommer, 1990). Schommer suggests that epistemological beliefs held by individuals may be at differing levels. If individuals' belief trends are sophisticated, the individuals believe that knowledge is not certain and or absolute, that a great part of it is in development, that a part of it has not yet been explored, and that only a small part of it is stable. Those individuals are knowledgeable and experienced, and they adopt a critical approach towards what they read. Yet those with naive epistemological beliefs are simple and inexperienced, and they believe that a great part of knowledge is certain and stable, that some knowledge will be newly explored, and that only a small portion of knowledge will change. They do not display a critical approach towards what they read, and they are likely to be influenced by what they read (Aypay, 2011a; 2011b; Deryakulu, 2002; Schommer, 1990; 1994).

Individuals with sophisticated epistemological beliefs are often more successful in their academic life, they employ learning and study strategies more effectively, and are more successful in controlling the extent to which they have comprehended the new knowledge (Schommer, 1990). According to a number of researchers, epistemological beliefs have impacts on such variables as individuals' ways of processing and interpreting the new knowledge, their levels of comprehension, the criteria to control their levels of comprehension, their choice of study strategies, their higher order thinking forms and problem-solving approaches, and efforts they make and time they spend for learning (Brownlee, Purdie, & Boulton-Lewis, 2001; Hofer & Pintrich, 1997; Tolhurst, 2007). Epistemological beliefs were found to be related to achievement motivation (Brâten& Olaussen, 2005; Brâten& Stromso, 2004; Buehl & Alexander, 2005; Chen & Pajares, 2010; DeBacker & Crowson, 2006; Muis, 2004; Muis & Franco, 2009) and to motivation and learning (Buehl & Alexander, 2005; Cavallo, Rozman, Blickenstaff, & Walker, 2003; Hofer & Pintrich, 1997; Paulsen & Feldman, 1999).

Motivation

On examining research studies conducted in relation to motivation, it was found that the concept of motivation was defined in different ways. Keller (1983) defines motivation as the direction of effort making a student willing to learn and as an intrinsic power while Schunk (1990) defines it as inclining towards a process of behaviour oriented to a certain goal and sustaining it; Kelecioğlu (1992) as the process enabling any activity to start and being influential in the direction, intensity and continuation of it; Dilts (1998) as a general power directing individuals or organisms to trigger them, as a stimulant or an influence; and Lindner (1998) as the power impelling individuals to attain individual or organisational objectives.

Related research in literature has revealed that there is a connection between students' motivation and their epistemological beliefs (Buehl & Alexander, 2005; Hofer, 1994, quoted by, Paulsen & Feldman, 1999; Paulsen & Feldman, 1999; Schutz, Pintrich, & Young, 1993, quoted by Paulsen & Feldman, 1999; Şen & Yılmaz, 2012). Bandura (1997) and Dweck and Leggett (1988) point out that the beliefs held by individuals are the factors affecting their thoughts, motivation and behaviours (quoted by Buehl & Alexander, 2005). Buehl and Alexander (2005), on the other hand, found that students with sophisticated epistemological beliefs had higher levels of motivation. In a research study, Buehl (2003) developed a model showing that students' epistemological beliefs had direct effects on their achievement, motivation and cognitive processes (that is to say, their use of strategies). On examining the results, it was found that

epistemological beliefs affected students' motivation, their cognitive processes and learning strategies, and that their epistemological beliefs also indirectly influenced their achievement and their academic performance. It was pointed out by the researcher that, according to the findings, further research was needed in order to explore the relations between epistemological beliefs and motivation.

Learning Strategies

Learning strategies are the behaviours and thoughts expected of learners during learning and influential in their process of encoding, and facilitating their learning. They are the cognitive plans designed so as to fulfil a duty (Weinstein & Mayer, 1986). They range from such simple analysis abilities as stating the main idea and underlining it to more complicated processes of thought such as using analogies to enable someone to set up associations between prior knowledge and new knowledge (Gözütok, 1990). According to Wittrock (1986), learning strategies are students' behaviours and thoughts arising in learning and affecting motivation, encoding of knowledge and permanence and transfer of it. Mayer (1988) suggests that learning strategies are the various thoughts and behaviours which are to be influential in individuals' processing the new knowledge to be acquired in their mind (quoted by Deryakulu, 2004). Learning strategies could be defined as learners' displaying the efforts needed for their putting the new knowledge presented to them into mental processes and making sense of it, and thus constructing it in the learning-teaching process or in their individual activities (Tay, 2004, 2005).

Such factors as the nature of the task, the orientation made by the teacher or the teaching materials, students' prior knowledge, their knowledge of learning strategies, their aims, their attitudes towards and beliefs in learning, the type and level of motivation are the factors influential in students' determining which learning strategy to use, in their using the selected strategy effectively and in their evaluating the results of strategy use (Deryakulu, 2004).

In research conducted by Pintrich and De Groot (1990) the relations between students' academic achievement, their motivation and learning strategies were investigated. Consequently, it was found that there was a positive relation between self-efficacy and intrinsic goal orientation, which were the sub-dimensions of motivation, and learners' cognitive behaviours and their performance; and it was also found that self-regulation, self-efficacy and test anxiety- the sub-dimensions of motivation- were the variables best predictive of academic performance. In their research, Zusho, Pintrich and Coppola (2003) investigated whether or not learners' motivation, their cognitive and metacognitive

learning strategies were predictive of their performance in the chemistry course. On evaluating the results of the study, it was concluded that the learners with higher self-efficacy and task value levels were better at the courses than those employing other learning strategies. Another conclusion reached by the researchers was that the students using the rehearsal strategy- a strategy of learning- displayed better performances than those using other strategies. In research performed by Yumuşak, Sungur and Çakıroğlu (2007), the effects of students' motivational beliefs and their use of cognitive and metacognitive learning strategies on their achievement in biology were examined. In consequence, it was found that extrinsic goal orientation and task value- the sub-dimensions of motivation- and rehearsal learning strategy, regulation learning strategy, time/study environmental management, and peer learning- the sub-dimensions of learning strategies were significantly correlated with students' achievement in biology. Besides, it was also found that the use of extrinsic goal orientation, rehearsal learning strategy and peer learning were in reverse correlation with students' achievement in biology.

In literature, it was pointed out that learners' epistemological beliefs influenced the teaching strategies chosen (Cotterall, 1999; Deryakulu, 2002, 2004, 2006; Horwitz, 1999; Mauren, 2010; Kardash & Howell, 2000; Schommer, Crouse, & Rhodes, 1992; Schreiber & Shinn, 2003; Tsai, 1997). Epistemological beliefs affect the type and level of learners' cognitive and metacognitive learning strategies, and they also affect students' looking at the knowledge in a critical way and their ways of thinking. Students with sophisticated epistemological beliefs are capable of employing cognitive and metacognitive learning strategies in a more effective and efficient way (Deryakulu, 2006). According to Richter and Schmid (2009), students with sophisticated epistemological beliefs use the simple learning strategies (such as rehearsal) less while they use deep strategies (learning approaches) more often. Köller, Baumert and Neubrand (2000) found positive correlations between high school students' simple learning strategies (rehearsal) and their beliefs in the truth and accuracy of knowledge whereas Köller (2001), Schiefe, Emgassen and Moschner (2003) found no significant correlations between high school and university students' simple learning strategies (rehearsal) and their beliefs in the truth and accuracy of knowledge.

The Purpose and Significance of the Study

Facilitating meaningful learning efficiently depends on conducting learning rather than teaching, students' acquiring the knowledge through taking active roles in learning rather than transferring the knowledge directly into the students, on the belief that each learner's individual differences are influential in learning, and on students' constructing the

new knowledge on their own. In pieces of research performed in literature such cognitive and motivational variables, as prior knowledge, attitudes, logical thinking, learning approaches, self-efficacy, goal orientation, and epistemological beliefs were studied (Buehl, 2003; Cavallo, Rozman, Blickenstaff, & Walker, 2003; Conley, Pintrich, Vekiri, & Harrison, 2004; Elder, 1999; Murphy, Buehl, Monoi, & Long, 2002; Paulsen & Feldman, 1999, 2005; Schommer, 1998; Sungur & Tekkaya, 2006). Of these variables affecting students' learning, motivation, epistemological beliefs and learning strategies are within the scope of this research. The intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy and belief in learning control sub-dimensions of the Motivated Strategies for Learning Questionnaire (MSLQ) were used in determining students' achievement motivation- as was the case in the research conducted by McKenzie and Gow (2004) and by McKenzie, Gow and Schweitzer (2004). And for the learning strategies, the factors of organisation, elaboration, metacognitive self-regulation, effort management and time/study environmental management of the MSLQ were used; because those factors account for the self-regulation definition offered by Zimmerman (1990) and reflect the deep learning approach (McKenzie & Gow, 2004; McKenzie et al., 2004). The factor of the belief that there is only one truth measures the beliefs in knowledge while the factors of the belief that learning depends on effort and the belief that learning depends on ability measure beliefs in learning. Due to the fact that this research is in search of studying students 'epistemological beliefs in learning, the factors of "the belief that learning depends on effort" and "the belief that learning depends on ability" were used in this research; and the hypothesis model in Figure 1 was developed accordingly. Thus, the purpose of this research is to analyse the correlations between educational faculty students' epistemological beliefs in learning, their achievement motivation, and learning strategies. In addition to that, another aim of the research is to examine whether students' epistemological beliefs influence their learning strategies directly or through the motivation variable. A hypothesis model established in accordance with the theoretical structure is shown in Figure 1.

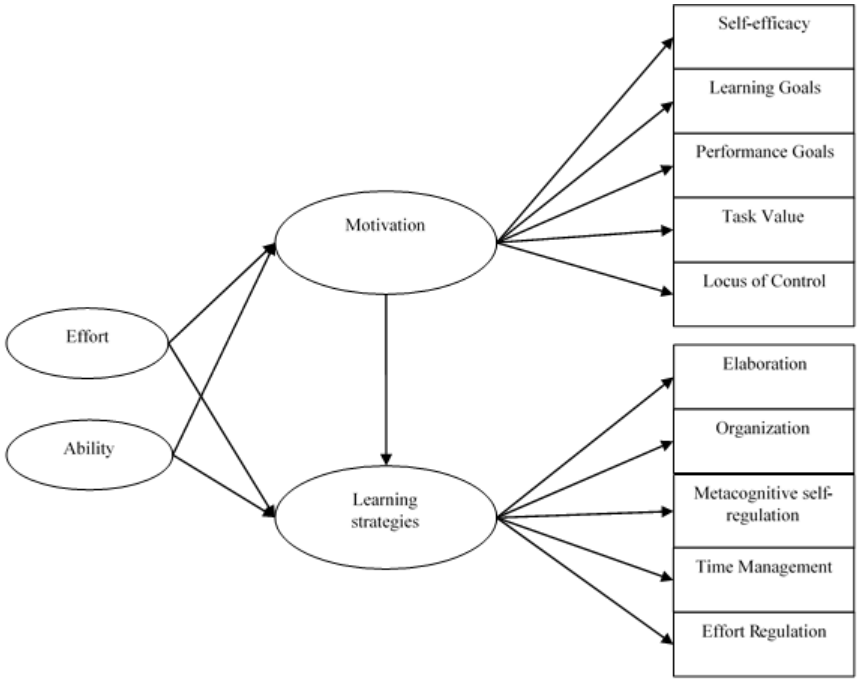

Figure 1. Hypothesis Model Holding between Epistemological Belief, Motivation and Learning Strategies

RESEARCH QUESTIONS

Answers were sought to the following questions in this research:

1. What is the structural equation model explaining the relations between educational faculty students' epistemological beliefs in learning, their learning strategies and achievement motivation?
2. Do the students' epistemological beliefs in learning influence their learning strategies directly or through the motivation variable?

RESEARCH METHODOLOGY

The Study Group

A total of 446 educational faculty students, 308 of whom were girls and 138 of whom were boys, took part in the research. 78 of the students were in biology teaching department, whereas 66 were in physics teaching, 117 were in chemistry teaching, and 185 were in science teaching departments.

Data Collection Tools

The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich, Smith, Garcia and McKeachie (1991) so as to evaluate university students' motivational adjustment and their use of different learning strategies for their courses at university. The questionnaire was adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004). It is a 7-pointed Likert type questionnaire. The MSLQ is composed of two main parts; namely motivation and learning strategies. The motivation part includes 31 items and 6 sub-dimensions. The sub-dimensions are: intrinsic goal orientation (IGO) (or learning goals), extrinsic goal orientation (EGO) (or performance goals), task value (TV), control of learning beliefs (COLB), self-efficacy for learning and performance (SFLAP), and test anxiety (TA). The learning strategies part, on the other hand, is related to differing cognitive and metacognitive strategies employed by students, and consists of 31 items. Besides, in addition to the 31 items, there are also 19 items related to the management of different sources. The learning strategies part contains 9 sub-dimensions; namely: rehearsal, organization, elaboration, critical thinking, metacognitive self-regulation, time/study environmental management, effort regulation, peer learning, and help seeking (Pintrich, et al., 1991; Büyüköztürk et al., 2004). High scores received from a factor in the Motivated Strategies for Learning Questionnaire shows that the student has the property related to the factor at high levels (Pintrich, et al., 1991; Büyüköztürk et al., 2000). This study employs the intrinsic goal orientation, extrinsic goal orientation, task value, self-efficacy for learning and control of learning beliefs sub-dimensions in order to determine students' achievement motivation (McKenzie & Gow, 2004; McKenzie et al., 2004). On the other hand, the factors of organization, elaboration, metacognitive self-regulation, effort management, and time/study environmental management were used for the learning strategies. These factors account for the definition of self-regulation offered by Zimmerman (1990), and are reflective of deep learning approach (McKenzie & Gow, 2004; McKenzie et al., 2004).

Epistemological Belief Scale was developed by Schommer (1990), and having performed the validity and reliability studies of the scale, it was adapted into Turkish by Deryakulu and Büyüköztürk (2002, 2005). It is a 5-pointed Likert type scale. It was found that the scale had a three-factor structure and that it consisted of 34 items in total. The scale had 17 items in the first factor called "the belief that learning depends on effort", 9 items in the second factor called "the belief that learning depends on ability", and 8 items in the third factor called "the belief that there is only one truth". The goodness of fit indices $\chi 2 = 1454, 50$ ($df=557$, $p<.001$), ($\chi 2/df$) = 2.61, RMSEA = 0.05, RMR = 0.09 obtained through the confirmatory factor analysis performed by Deryakulu and Büyüköztürk

(2005) were in the form of standardized RMR = 0.07, GFI = 0.88 and AGFI = 0.87. The Cronbach Alpha internal consistency coefficients were calculated in order to evaluate the scale in terms of the extent to which it was reliable in distinguishing individuals in their epistemological beliefs. The Cronbach Alpha internal consistency coefficients were found to be .84 for Factor 1, .69 for Factor 2, .69 for Factor 3, and .81 for the overall scale. The higher scores received from each factor of the scale state that the individual holds naive beliefs while the lower scores state that the individual holds sophisticated beliefs for those factors. Of the factors available in the scale, "the belief that there is only one truth" measures beliefs in knowledge whereas "the belief that learning depends on effort" and "the belief that learning depends on ability" measure beliefs in learning. Since this research makes an attempt at analyzing students' epistemological beliefs in learning, the factors of "the belief that learning depends on effort" and "the belief that learning depends on ability" were used in the research.

Data Analysis

The data obtained were analysed through confirmatory factor analysis and path analysis. Confirmatory factor analysis was employed in testing the measurement models whereas path analysis was used in testing the structural model. The LISREL 8.7 program was employed for modelling study with the variables determined.

FINDINGS AND CONCLUSIONS

In relation to the first sub-problem, initially the measurement models for all variables were tested in the research and the fit indices were examined. The fit indices were obtained through analyses that were performed by considering the modifications which were offered by the programme and which were theoretically significant (Table 1).

After selecting and applying the suitable modifications which were offered by the programme and which were theoretically significant, and by taking the fact that the models were complex and multivariate into consideration, the chi-square/df, RMSEA, CFI, GFL, AGFI, NFI and NNFI fit indices in Table 1 were regarded as displaying goodness of fit indices for the four measurement models (Çokluk, Şekercioğlu & Büyüköztürk, 2010; Haşlaman & Aşkar, 2007; Şimşek, 2007).

Table 1. The Fit Indices for Measurement Models

	N	χ2	df	χ2/df	RMSEA	CFI	GFI	AGFI	NFI	NNFI
Learning Strategies	446	12.72 p = 0.013	4	3,18	0.070	0.99	0.99	0.96	0.98	0.97
Motivation	446	12.82 p = 0.012	4	3,21	0.070	0.99	0.99	0.96	0.99	0.98
Effort	446	343,25 p= 0.00	113	3,04	0,068	0.86	0.92	0.89	0.81	0.83
Ability	446	48,25 p = 0.00	20	2,41	0.056	0.93	0.97	0.95	0.88	0.90

In line with the purpose of the research, following the path analysis performed for the theoretical structure revealing the relations holding between students' epistemological beliefs in learning, their achievement motivation and learning strategies it was found that the path coefficients predicted between the belief that learning depends on ability in the theoretical model and motivation (the standardised path coefficient= 0.00; p>0.05) and between the belief that learning depends on ability and learning strategies (the standardised coefficient=-0.06; p>0.05) were not statistically significant. Therefore, the alternative model was established instead of the theoretical model, and the model was tested.

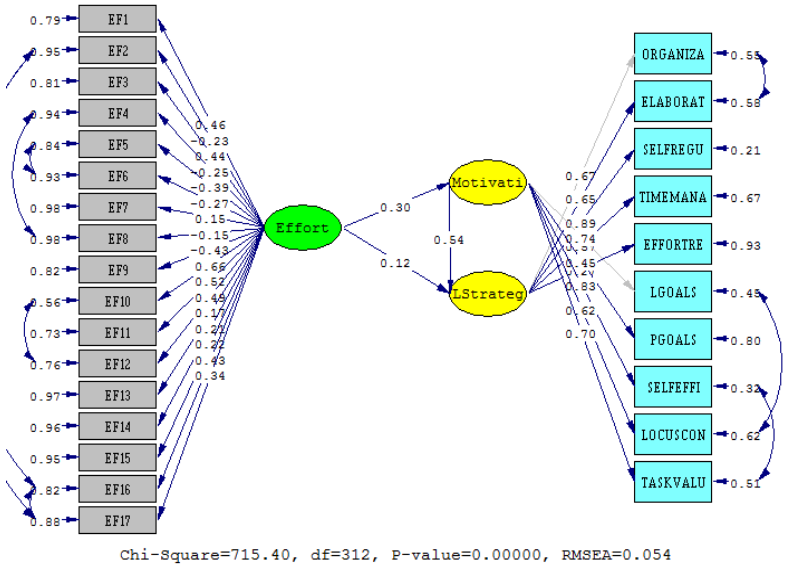

Figure 2. The Analysis Results for the Structural Equation Modelling (the standardised path coefficients are given)

Table 2. The Fit Indices for the Analysis Results of the Structural Equation modelling

N	χ2	df	χ2/df	RMSEA	CFI	IFI	GFI	AGFI	NFI	NNFI
446	715,40 (P=0,00)	312	2,30	0.054	0.92	0,92	0.89	0.87	0.86	0.91

In consequence of the analyses conducted in Table 2, the fit indices for the alternative model (chi square=715.40 (p=0.00) Chi square/df=2.3 RMSEA=0.054, CFI=0.92, GFI=0.89, AGFI=0.87, NFI=0.86, and NNFI=0.91) were considered to satisfy the criterion of goodness of fit indices. Therefore, the model may be said to yield results compatible with the whole data. As is clear from Figure 2, a positive and significant correlation was found between the belief that learning depends on effort, the learning strategies and the motivation scores. The scores for the belief that learning depends on effort accounts for 30% of the variance in motivation scores and 12% of the variance in learning strategies scores. The motivation score, however, accounts for 54% of the variance in learning strategies scores.

In relation to the second sub-problem of the research, the mediator role of motivation was examined in the relations between the belief that learning depends on effort and motivation and learning strategies in the alternative model that was established as different from the hypothesis model. In order to determine the mediation relation, the variable of the belief that learning depends on effort should predict the motivation and the learning strategies variables separately; and motivation should satisfy the prediction conditions for predicting the learning strategies on checking the variable of the belief that learning depends on effort. Besides, on checking the motivation variable, a reduction in the amount of the relations between the belief that learning depends on effort and the learning strategies (i.e. partial mediation effect) or the statistical insignificance of the relation (full mediation) is an indicator of the mediation effect. For the purposes of satisfying these conditions, after the path analyses, it was found that the belief that learning depends on effort was the predictor variable, motivation was the predicted variable, (standardized coefficient=0.25; $p<0.05$), and that the path coefficients were significant. Afterwards, a path analysis was done, where the learning strategies were the predicted variable and the motivation was the predictor variable. In consequence of the analysis, it was found that the ties between the belief that learning depends on effort and the learning strategies (the standardized coefficient=0.12; $p<0.05$) were significant; but that there was a reduction (from 0.25 into 0.12) in the amount of standardized coefficient

(partial mediation). In this case, it may be said that the effect of partial mediation is available.

DISCUSSION

This study examined the relations between educational faculty students' motivation, their learning strategies and epistemological beliefs; and investigated to see whether or not the motivation variable functioned as a mediator in the relation between epistemological beliefs and learning strategies. After the path analysis performed, it was found that the conceptual path coefficients between the belief that learning depends on ability and motivation and learning strategies were not significant. Thus, the alternative model which was offered by the programme and which was theoretically significant was analysed instead of the theoretical model. It was found that, of these variables available in the alternative model, the belief that learning depends on effort affected the learning strategies directly, and that it also affected the learning strategies indirectly through the motivation variable.

Since teaching design and learning environments are prepared by considering learners' properties, learners' having sophisticated epistemological beliefs will raise their motivation in a positive way while at the same time it will assure the effective use of learning strategies. Studies in literature point out that epistemological beliefs affect teaching strategies (Cotterall, 1999; Deryakulu, 2002, 2004, 2006; Horwitz, 1999; Kardash & Howell, 2000; Maureen, 2010; Richter & Schmid, 2009, Schommer et al., 1992; Schreiber & Shinn, 2003; Tsai, 1997). This current study has also reached the conclusion that students' belief that learning depends on effort influences their learning strategies both directly and indirectly. Based on this conclusion, it is clearly seen that students' belief that learning depends on effort has significant effects on their learning strategies and their motivation. Students holding sophisticated epistemological beliefs are successful in self-motivating during learning; and they are likely to put the newly presented knowledge in their mental processes and thus use the learning strategies effectively necessary for making sense of and constructing the new knowledge Therefore, students with sophisticated epistemological beliefs will tend to believe that they have the abilities needed for meaningful learning in the classroom environment and to make more efforts for learning. Beside these efforts, the influence of another variable, motivation, which is one of the important learner properties, will also make students more successful and enable them to receive higher grades. Kardash and Howell (2000) found that students believing that learning depends on effort employ cognitive learning strategies more often than other students. Schreiber and Shinn (2003), on the other hand, found that students believing that learning

depends on ability employed learning activities based on memorising factual knowledge more often than in-depth and exploratory knowledge processing activities. In this current research, it was found that students' belief that learning depends on effort had positive and significant relations with their achievement motivation and learning strategies. Besides, it was also found in this research that there were no significant relations between students' belief that learning depends on ability and their achievement motivation and learning strategies.

Studies in relevant literature report that correlations are available between students' motivation and their epistemological beliefs (Buehl & Alexander, 2005; Hofer, 1994, quoted by Paulsen & Feldman, 1999; Paulsen & Feldman, 1999; Schutz, Pintrich, & Young, 1993, quoted by Paulsen & Feldman, 1999; Şen & Yılmaz, 2012). In consequence of the path analysis performed, it was found that students' belief that learning depends on effort predicted their motivation. Students' belief that learning depends on effort has significant impacts on their motivation. Neber and Schommer-Aikins (2002) pointed out that individuals holding naive beliefs in the stability of ability had lower objectives. That students with sophisticated belief in learning control have sophisticated intrinsic goals is another important finding that has been suggested in field literature (Deci, Vallerand, Pelletier, & Ryan, 1991). Such findings demonstrate that when students hold sophisticated epistemological beliefs, their motivation will also be influenced by this in a positive way and will be raised. Learners' sophisticated beliefs concerning what knowledge is, how knowing and learning occur will contribute to the rise in their motivation for learning.

In consequence, it was found in this research that the learning strategies chosen and employed by students were predicted by motivation. This finding may be said to be supportive of the results obtained in previous research studies. In research conducted by Pintrich and De Groot (1990), Zusho et al., (2003) and by Yumuşak et al., (2007) correlations were found between students' learning strategies and their motivation. Moreover, it was also stated in literature that motivation was an important factor influential in students' use of their metacognitive abilities and in their effort management (Pintrich, 1999; Zimmerman, 2000). In a similar vein, Sungur (2007) also found that students with higher motivation made more efforts for learning and employed various learning strategies despite difficulties. Thus, motivational beliefs can account for why some students are more successful and some are less successful in the learning process. Students with higher motivation are capable of employing the learning strategies facilitating their learning and affecting their encoding processes more effectively. Students' achievement in the use of learning strategies will also increase their academic achievement.

Such properties as students' beliefs, their conception of learning and their motivation affect their learning processes, learning outputs and their

achievement (Chan, 2007). Because the goal in education is to raise students' academic achievement and to make their learning outputs more qualified, the studies concerning learners' motivation and beliefs should be performed by teachers and educators. By considering the mediator role of motivation that was found in this research, more effective programmes and activities could be implemented. That the belief that learning depends on effort influences the learning strategies both directly and indirectly through motivation exhibits how important epistemological beliefs are. The issue that developing epistemological belief through research to be performed by teachers and educators is a top priority has become apparent with this research.

University students' motivational beliefs have direct effects on their academic achievement. Their academic achievement is also influenced due to the mediator effects of their motivational beliefs on the use of their self-assessment strategies (Paulsen & Gentry, 1995; Pintrich & Schrauben, 1992, quoted by Paulsen & Feldman, 1999). Students' epistemological beliefs affect their motivational beliefs, cognitive strategies and learning outputs (Bruning, Schraw, & Ronning, 1995, quoted by Paulsen & Feldman, 1999; Hofer & Pintrich, 1997; Schommer, 1990). As supportive of the findings in literature, the patterns between learning strategies, motivation and epistemological beliefs were analysed in this research, and it was found that the belief that learning depends on effort has both direct and indirect effects on learning strategies. In further research to be conducted in the future, achievement variable could also be added to the models to be constructed so as to evaluate the relations between epistemological beliefs, motivation and learning strategies. Thus, in addition to the direct and indirect effects of epistemological beliefs on achievement, the relations between motivation, learning strategies and achievement will also be understood better. The significant and new knowledge to be obtained in those prospective studies would enable teachers and educators to understand the relations between a numbers of variables, which are effective in learning, clearly. Thus, the learning environments and teaching designs necessary for meaningful learning to occur can be prepared by teachers and educators.

One of the restrictions in this research was that it was conducted only with the students of the faculty of education. Hence, implementing the model suggested here with students of other faculties and of high schools may show whether or not the model is appropriate for those students. In this way, the new findings to be obtained by the researchers will give the opportunity to make generalizations on the fit of the model.

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