PREDICTIVE INFLUENCE OF STUDENTS ACHIEVEMENT MOTIVATION, MEANINGFUL LEARNING APPROACH AND EPISTEMOLOGICAL BELIEFS ON CLASSIFICATION CONCEPT ACHIEVEMENT

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
THE MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF ELEMENTARY SCIENCE AND MATHEMATICS EDUCATION

SEPTEMBER 2007

Approval of the Graduate School of Social Sciences

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ABSTRACT

PREDICTIVE INFLUENCE OF STUDENTS ACHIEVEMENT MOTIVATION, MEANINGFUL LEARNING APPROACH AND EPISTEMOLOGICAL BELIEFS ON CLASSIFICATION CONCEPT ACHIEVEMENT

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September 2007, 80 pages

The purpose of the present study was to investigate the predictive influences of epistemological beliefs, achievement motivation, learning approaches on sixth grade students' achievement in classification concepts. The study was carried out in the fall 2006-2007 semester. One thousand forty one 6th grade students from twenty five randomly selected elementary schools in Çankaya district of Ankara participated in this study. In this study Turkish version of the Learning Approach Questionnaire, Epistemological Beliefs Questionnaire, Achievement Motivation Questionnaire and Classification Concept Test were used as measuring instruments to collect relevant data.

Multiple Regression Correlation Analyses was computed in order to find out the contribution of students' learning approaches, epistemological beliefs and achievement motivation to their achievement in classification concepts. The results

revealed that these variables explaining 14% of the variation in students' achievement in classification concepts. Stepwise multiple regression analyses was conducted in order to find out which variable best predicted students' achievement in classification concepts. Students' learning approaches were found to be the best predictor of achievement explaining 12% of the variance. The remaining 2% of variance was explained by epistemological beliefs of the students. Achievement motivation, however did not contribute to students' achievement in classification concepts.

Results also revealed significant positive correlations between students' achievement in classification concepts, their learning goal orientations, epistemological beliefs and learning approaches. Students' performance goal orientations, and self efficacy beliefs, however, were not found to be related to their achievement in classification concepts.

Keywords: Achievement motivation, elementary students, epistemological beliefs, learning approach, classification

ÖZ

ÖĞRENCİLERİN SINIFLANDIRMA KONULARINDAKİ BAŞARILARININ EPİSTEMOLOJİK İNANÇLAR, MOTİVASYON VE ÖĞRENME YAKLAŞIMLARI İLE TAHMİNİ

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Bu çalışmanın amacı; altıncı sınıf öğrencilerinin sınıflandırma konusundaki başarılarını, epistemolojik inançların, motivasyonun, öğrenme yaklaşımlarının ne kadar tahmin ettiğini araştırmaktır.Bu çalışma 2006-2007 yılının güz döneminde gerçekleştirilmiştir. Çalışmaya, Ankara'nın Çankaya ilçesinden rasgele seçilen 11 okuldan toplam 1041 altıncı sınıf öğrencisi katılmıştır.Çalışmada, ölçüm araçları olarak Epistemolojik İnançlar Anketi, Öğrenme Yaklaşımları Anketi, Başarı Motivasyonu Anketi ve Sınıflandırma Kavram Testi kullanılmıştır.

Çoklu regrasyon analizi sonuçları öğrencilerin öğrenme yaklaşımları, epistemolojik inançları ve başarı motivasyonlarının sınıflandırma konusundaki başarılarının, %14'ünü açıkladığını göstermiştir. Aşamalı çoklu regrasyon analizinde öğrencilerin başarılarını hangi değişkenin en iyi tahmin ettiği araştırılmış ve öğrencilerin öğrenme yaklaşımlarının başarılarını % 12 oranında tahmin ettiği bulunmuştur. Kalan %2'lik kısmı ise öğrencilerin epistemolojik inançlarının açıkladığı saptanmıştır.

Değişkenler arasındaki ilişkiler incelendiğinde öğrencilerin Sınıflandırma Kavram Testi (CCT) skorlarının ayrı ayrı, öğrenme yaklaşımları, epistemolojik inançları ve öğrenmeye dayalı hedefleri ile pozitif ve anlamlı bir ilişkide olduğu saptanmıştır. Ayrıca öğrencilerin öğrenmeye dayalı hedefleri, öğrenme yaklaşımları, epistemolojik inançları ve performansa dayalı hedefler, öğrenmeye dayalı hedefler ve öğrencilerin öz yeterlik inançları arasında da pozitif ve anlamlı bir ilişki bulunmuştur.

Anahtar Kelimeler: Başarı Motivasyonu, ilköğretim öğrencileri, epistemolojik inançlar, öğrenme yaklaşımları, sınıflandırma

To My Mother

& All People who are trying to reach their ambitions everyday

ACKNOWLEDGEMENTS

I would like to thank to my Supervisor Assoc. Prof.Dr. Ceren Tekkaya for her continuous, encouraging efforts, constructive and valuable criticism, and friendship throughout this study.

I would like to thank to Assist.Prof. Yeşim Çapa Aydın and Assist. Prof. Dr.Semra Sungur for their helps in analysing the data and their valuable advices.

I would like to thank to Şule Özkan for her supports.

I also extend my gratitude to all the students participated in this study and to Sevgi Peker who motivated me during the applications.

I am also grateful to examining committee members for their valuable comments. Their recommendations were really constructive and provided valuable ideas for a better work.

I would like to thank to Cihan Selçuk, for his friendship, moral support and technical help through out the study.

I am also grateful to my close friends, Didem, Gülbir, Gülcan and Sargun for their moral support, their cheerful and constructive dialogues, and friendship that made the duration more standable and productive.

I would like to thank to my friends from the department; Gülsüm and Savaş for their cheerful dialogues in their room which motivated me all the time.

I would like to thank to Ata for making life enjoyable, sharing it with me, supporting and motivating me during the last three difficult months of the study.

I am particularly thankful to my mum for she believed in me and supported me in my whole life with her love and caring.

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DV : Dependent Variable
IV : Independent Variable
CCT : Classification Concept Test
EBQ : Epistemological Beliefs Questionnaire
LAQ : Learning Approach Questionnaire
AMQ : Achievement Motivation Questionnaire
PGO : Performance Goal Orientation
LGO : Learning Goal Orientation
SE : Self Efficacy
EB : Epistemological Beliefs
LA : Learning Approaches
MRC : Multiple Regression Correlation
SPSS : Statistical Package for Social Sciences
M : Mean
SD : Standard Deviation

CHAPTER 1

INTRODUCTION

Achievement in science education has become a significant topic for researchers for years. Accordingly, how different variables of learning contribute to students' achievement in science has been examined by many researchers. In these studies, generally, prior knowledge, attitude, reasoning ability, approaches to learning, self-efficacy, goal orientations, and epistemological beliefs were considered as cognitive and motivational variables (Buehl 2003; Cavallo, Rozman, Blickenstaff & Walker 2003; Cavallo, Potter, & Rozman, 2004; Conley, Pintrich, Vekiri, & Harrison 2004; Elder 1999; Murphy, Buehl, Monoi & Long 2002; Schommer 1998; Paulsen & Feldman 1999; 2005).

Students' epistemological beliefs, for example, play important role in the learning process (Ryan, 1984; Schommer, 1993). Therefore these beliefs became the focus of many research studies in literature. Epistemological beliefs can be considered as system of beliefs that are relatively independent of each other and that affect learning directly and indirectly (Schommer, 1994; Schommer-Aikins, 2002). These beliefs are the individuals' beliefs about the source, certainty, and organization of knowledge, as well as the control and speed of learning (Schommer, 1990, 1994a, 1994b). Schommer (1990) defined these beliefs with five dimensions: Simple knowledge, certain knowledge, omniscient authority, quick learning and innate or fixed ability. Simple Knowledge means knowledge is 'simple rather than complex'; Omniscient Authority implies, `knowledge is handed down by authority rather than from reason'; Certain Knowledge indicates, `knowledge is certain rather than tentative'; Innate Ability means `the ability to learn is inborn rather than acquired', and Quick Learning is `learning is quick or not at all'. Research showed that these

beliefs have significant affect on academic performance (Hofer, 2000; Ryan, 1984; Schommer, 1993). For example, in two subsequent studies Schommer and her colleagues showed the affect of belief in quick learning and belief in simple knowledge on students' academic success. In these studies, relationships between students' epistemological beliefs and their comprehension performance indicate that belief in quick learning and belief in simple knowledge predict lower scores on comprehension tests and overconfident predictions of test performance and belief in quick learning was related negatively to students' grade point averages (Schommer, 1990; Schommer, Crouse, & Rhodes, 1992).

In addition to the epistemological beliefs, another variable that affects academic performance and learning is students' approaches to learning. Meaningful learning involves formation of possible relationships among ideas, concepts and information (Williams & Cavallo, 1995). If a learner does not relate his/her new knowledge with the previous, rote learning occurs. On the contrary, if that learner makes associations with new knowledge and preexisting ideas, meaningful learning occurs. According to Cavallo and Schafer (1994) students who learn by memorizing facts and definitions, can not relate this information with new problems, and they can not make interconnections between concepts. These authors also declared that students who have meaningful learning orientations have the ability to personalize concepts, link these concepts to their prior knowledge, and apply these newly learned concepts to solve problems. In his study, Cano (2005) showed that learning approaches and epistemological beliefs were the two predictors of academic achievement, and they were significantly interrelated. Students' epistemological beliefs were influenced by their learning approaches and this relation affected academic performance. The results of his study indicated that believing that learning occurred quickly and without effort, brought surface approach, which in turn was linked negatively to performance. Believing that learning occurs in a period and takes time brought deep approach, and was related negatively with naive epistemological beliefs. This study revealed that unsophisticated epistemological beliefs of students resulted in poor academic performance.

Motivation is another important variable as it plays a role in students' science achievement (Napier & Riley, 1985), conceptual change processes (Lee,1989; Lee & Brophy 1996; Pintrich, Marx & Boyle, 1993), , critical thinking and learning strategies (Garcia & Pintrich 1992; Kuyper, Van der Werf, M & Lubbers, M, 2000; Wolters, 1999). Motivation is individual's desire to act or behave in a particular manner (Weiner, 1992). Motivation in the context of schooling is very important. Achievement motivation is an important example of motivation in school contexts. It contains goal orientations of learners that are significantly related to their task choice, persistence, strategy use, and academic achievement (Ames, 1992; Anderman & Maehr, 1994). Achievement motivation also contains students' self efficacy beliefs which are students' beliefs about their own capability to be successful in a particular subject area or course (Bandura, 1995). Considering goal orientations, motivation researchers found a relation between learners' goal orientations and their academic achievement (Ames, 1992; Dweck, 1999; Pintrich, 2000; Eccles & Wigfield, 2002). Goal orientations are the clue that shows the reason of learner's choice of achievement behavior (Ames, 1992). According to Elliot (1999), goal orientations deal with the purposes for engaging in achievement behavior and leads individuals define and judge their performance in terms of some standards of quality. For instance, students motivated towards performance goals such as the desire to achieve high grades , praise or to perform better than other students, do not concentrate on learning something new for the sake of learning. On the other hand students with learning goal orientations are intrinsically motivated and have desire for learning new things. Apart from goal orientations, students' self efficacy beliefs affect their academic achievement. The level of self efficacy students have is important in academic achievement and students with high self efficacy are likely to attain higher achievement in a subject, whereas those with lower self efficacy tend to be less successful. Self efficacy affects students' choices of activities, efforts and persistence while learning new things (Bandura, 1977, 1982, 1989; Schunk, 1989a, 1989b; Zimmerman et al., 1992). According to Schunk (1983), high sense of efficacy increases participation in tasks and achievement. Conversely, lower levels of efficacy results in less persistence and lower

achievement (Collins, 1982). Self-efficacy affects learning by encouraging perseverance and providing confidence to try different strategies .Those who distrust their ability to succeed tend to give up a learning process if early efforts do not result in perceived success (Brown & Inouye, 1978; Schunk, 1984).

Bandura (1997) indicated that mastery and vicarious experiences may allow students to form beliefs about their own abilities. Students can contact with knowledge and this may affect their self efficacy judgments for future learning tasks. That is, students' beliefs about the nature of knowledge in a specific domain may affect how difficult they believe the learning task will be.

Literature revealed an association between achievement motivation and epistemological beliefs of students. Regarding goal orientation dimensions of achievement motivation, Paulsen and Feldman (1999) showed that students who were aware of the complexity of knowledge and believed that learning requires time and effort tended to accept the more adaptive mastery (task or learning) goal orientations. In contrast, students who viewed knowledge as isolated and believed that learning is a process that occurs quickly tend to adopt performance (ego or ability) goal orientations. Regarding self efficacy belief component of achievement motivation, previous research indicated that students' beliefs about knowledge were related to their competency beliefs (e.g.; Hofer; Paulsen & Feldman, 1999). In their study, Paulsen and Feldman (1999 indicated negative correlation between self-efficacy and students' beliefs about the simplicity of knowledge and the innateness of the ability to learn. In contrast, Neber and Schommer-Aikins (2002) found that believing success was unrelated to hard work negatively predicted students' science self-efficacy. Additionally, students' beliefs about the simplicity of knowledge were negatively related to self-efficacy. In another investigation, Hofer (1999) examined beliefs in relation to students' self-efficacy for mathematics. She found that students' who believed mathematics knowledge existed in isolation tended to have lower levels of mathematics efficacy.

By considering the importance of epistemological beliefs, learning approaches, achievement motivation in students' science achievement, current study explored the predictive influence of above-mentioned variables in elementary students' classification concept achievement. Classification topic was chosen in order to examine the effects of all the variables of this study on its achievement. Classification topic is a central topic in both science and biology and has important roles in understanding biological diversity, evolution, ecology, anatomy and physiology by making scientific reasoning more organized and structured.(Yen, Yao & Mintzes, 2007). Although this topic is taught in all level of education, students of various ages have misconceptions and trouble in understanding this topic (Bell, 1981; Bell & Barker 1982; Braund 1998; Trowbridge & Mintzes 1985; 1988; Yen et al. 2007).

1.1 Significance of the study

The previous studies examined the variables of this study and revealed the associations among them. In those studies, significant correlations between students' epistemological beliefs and a variety of learning outcomes including academic achievement have been indicated so far. In the light of these studies, it can be concluded that the variables examined in this study play important roles in science achievement. In Turkey, constructivist classrooms in which students are more active and construct their own knowledge have been emphasized for recent years. However, before there used to be traditional classrooms in which teacher was the authority in the classroom and students were the passive receivers. The aim of new science curriculum today is providing student centered classrooms in which students construct their own knowledge by the guidance of their teachers. In addition, it aims to educate students who use their knowledge in daily life, form relationships with his/ her new knowledge and previous knowledge. This new science curriculum also aims to promote meaningful learning, develop scientifically literate students. Therefore, determining students' epistemological beliefs, learning approaches and investigating their contribution to students' science learning is gaining vital importance. Regarding these important variables of current study, the majority of

previous research concentrated on older participants from college and high school and few of the studies concentrated on young learners. Moreover, most of the studies were held in Western countries for many years and studies on non-Western countries have received little attention. Accordingly, this study aims to find out sixth grade students' epistemological beliefs, learning approaches and explore how they contribute to the achievement in classification topic.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1. Introduction

In this part of the study, the previous studies about science achievement, epistemological beliefs, learning approaches, achievement motivation of students and their relationships with each other are introduced in order to give a general idea about the back ground of the current study.

Originating from the work of Perry, the focus of epistemological beliefs in learning and academic development has become an active research topic during the past 10 to15 years (Muis, 2004; Schraw & Sinatra, 2004). Epistemology deals with the nature of knowledge and justification of beliefs. According to Schommer, epistemology is "a belief system that involves several more or less independent dimensions." (Schommer 1990, p.498). In addition to explaining multidimensionality of epistemological beliefs, Schommer proposed four beliefs about the nature of knowledge: Simple knowledge (knowledge is simple rather than complex), certain knowledge (knowledge is certain rather than tentative), innate ability (the ability to learn is innate rather than acquired), and quick learning (learning is quick or not at all). Schommer (1990) demonstrated the affect of some of these beliefs on college students' academic performance. In her study it is stated the more students believe in quick learning, the more poorly they understand text and monitor their understanding; the more students believe in certain knowledge, the more likely they are to interpret tentative information as absolute. In one of her studies, Schommer (1993) also showed the relationship between beliefs about knowledge and GPA of American high school students (n=1000). The results revealed that students' having

the idea that knowledge is a set of isolated facts and that knowledge is certain have lower overall GPA's. In the same study, Schommer pointed out the ongoing development of epistemological beliefs during high school years. It is reported that belief in simple knowledge, certain knowledge, and quick learning changes from freshman to senior year. Later, Elder (1999) noticed that elementary grade students also hold beliefs about the nature of scientific knowledge. She examined 5th grade students' epistemological beliefs in science and relation of such beliefs to science learning. Elder mentioned that elementary-aged students appear to depend on specific constructs like the changing nature of knowledge and the purpose of science while trying to follow a larger field of epistemological beliefs and that may initially come to understand the nature of scientific knowledge in a very situated, topic-dependent manner. Her study also demonstrated that 5th-grade students' beliefs were modestly related to their science learning.

In another study, Smith, Maclin, Houghton and Hennessey (2000) emphasized the changes in epistemological beliefs of elementary students and the effect of the type of curriculum on epistemological beliefs. The participants in their study were 59 American sixth grade students from two different classes (22 students from one class and 27 students from another). Each class had worked with the same science teacher throughout elementary school: Students in constructivist classroom were taught by Hennessey for six years. In their classroom teacher was a facilitator who tried to encourage the engagement of students' own ideas. Students in the comparison classroom had been with the same teacher for 5 years. In that classroom, more traditional, knowledge unproblematic approach was emphasized. As a result of their study, even elementary school students could develop more sophisticated, constructivist epistemology of science if they were educated with a curriculum that supported students' thinking about epistemological issues. Results also showed that students in the more traditional science classroom had developed uncomplicated epistemology. On the other hand in the constructivist classroom students developed more sophisticated epistemological beliefs than their peers in the traditional classroom. These students centrally knew that science contains the development and adjustment of ideas about the mechanism of world. They also knew the necessity of

time and effort for the development and understanding of these ideas, value of experiments both in clarifying and testing ideas, and significance of teamwork in all parts of the procedure.

In a more recent study, Conley, Pintrich, Vekiri, and Harrison (2004) examined the changes in epistemological beliefs over time and roles of gender, ethnicity, socio-economic status (SES), and achievement in the development of these beliefs. In the study, self-report questionnaires containing four dimensions of beliefs (source, certainty, development, and justification) were given to 187 (57% female) ethnically diverse (46% Latino, 27% Anglo, and 27% African American) fifth grade students from 12 American elementary school classrooms in the Southwest. In the classrooms of this study, the emphasis was on collecting data, making observations, comparing findings from different studies, and making claims using evidence. In those classes hands on instruction was used which would lead to less reliance on authorities such as the teacher or textbooks as well as some doubts about the certainty of knowledge, given the high potential for different students to generate different results from their hands-on experiments. The results indicated sophistication in students' beliefs about source and certainty of knowledge over time, however, no reliable changes in development and justification were revealed. The results couldn't reveal important differences by gender, ethnicity and SES.

In another study, Schommer and Hutter (2000) investigated the relationship between individuals' beliefs about the nature of knowledge and the nature of learning (epistemological beliefs) and their thinking about everyday controversial issues. Their study was held with one hundred and seventy-four adults (120 women and 54 men) having various education backgrounds, jobs and ages. The individuals, who believed in the complexity of knowledge, did not hesitate to state the complexity of knowledge, engaged in multiple perspectives, had flexible thinking, and had insightful manner. In addition, individuals who believed in the developing nature of knowledge admitted complicated aspects of an issue and think that today's answers may not be suitable for future.

Braten and Stromso (2004) examined the role of epistemological beliefs in self reports of Internet-based learning activities in a sample of 80 Norwegian student teachers in a new pedagogical context and this context's emphasis was on the use of information and communication technologies. The results of this study showed that epistemological beliefs about the speed of knowledge acquisition and certainty of knowledge affected the engagement of students. In their study, students who believed that learning was a quick process found managing the wealth of information on the Internet and critically evaluating Web-based resources difficult and time-consuming. In addition, students who held the naive epistemological belief that knowledge is given and stable were less likely to engage in discussion and communication about subject content on the internet.

In summary, the studies exploring the epistemological beliefs generally revealed that epistemological beliefs develop over time and are associated with academic performance.

Besides achievement, Schommer (1990) implied that students' epistemological beliefs influence their approaches to learning and consequential outcomes of their learning. Tsai (1998) supported this idea by declaring the probable effects of learners' scientific epistemological beliefs on their meta-learning and learning approaches.Tsai (1998) investigated the relationship between 8^{th} grade Taiwanese students'(n=202) epistemological beliefs and learning approaches. There were four classes of students who were taught by four different science teachers. The educational background of the teachers were similar .In addition, the teaching style of all of those teachers was traditionally oriented. The results showed some differences between constructivist oriented students and empiricist students. For instance, constructivist students had a tendency to consider science as an everyday life process which is conducted by people. They emphasized the tentative nature of knowledge. According to them; scientists do not have certain methods and procedures. Those students also believed that there were no clearly correct answers and natural phenomena can be understood through different but valid perspectives. They wanted to have learning science environment which provides opportunities to

discuss with others, have problems related with real-life, and to manage their own learning activities. They used their previous knowledge and construct their own ideas and could control learning meaningfully. Constructivist students tended to prefer learning the depth, of scientific knowledge. For instance, they chose learning the big ideas and the basic ideas. They emphasized the necessity of enough time to construct knowledge and the importance of discussion without the fear of making mistakes. Conversely, empiricist students tended to declare that science was consisted of correct facts. They also tended to underline the validity and accuracy of scientific knowledge. They believed that the best learning took place when teachers could clearly present their ideas. According to the results, empiricist students said that, a successful science teacher had the ability to clarify the correct scientific facts. They also believed that science is a fixed body of infallible facts or received knowledge; they supposed that one can learn science at any point. They saw science as some static information already existing there for them to learn; for that reason, they found constructing their ideas right in the class unnecessary. They thought that outside of the class was suitable to transfer the facts from there into their mind directly.

In their study, Burnett, Pillay and Dart (2003) investigated mediating effect of learner self concept between conceptions of learning and students' approaches to learning. A sample of 355 Australian high school students participated in the study. Most of the students were from 8^{th} and 9^{th} grades. The students completed questionnaires relating to their conceptions of learning, self concepts of themselves as learners, approaches to learning. They were asked to answer the questions within the context of particular subject in which they completed the questionnaire (English, Languages, History, Maths, Science, Art and Legal Studies). Results indicated the effect of learner self concept on conceptions of learning and approaches to learning. Accordingly, conceptions or beliefs about learning influence students' self concepts as a learner which in turn impacts on the way students carry out their learning. The results indicated that the secondary school students in that study who use a deep approach liked and enjoyed learning new things and viewed learning as a product of experience, as developing social competence indirectly and as personal change directly. Furthermore, students who adopted a surface approach to learning notified

that they were not good at learning, and also had an Achieving Approach. They also indirectly viewed learning as developing social competence. Finally, students who adopted Achieving Approach also had a deep approach, liked learning new things, viewed learning as developing understanding and indirectly viewed learning as a product of experience and as developing social competence.

In a recent article, Cano (2005) explored the effects of 1600 Spanish middle, junior and senior secondary school students' epistemological beliefs on their learning approaches and showed the direct and indirect effect of epistemological beliefs on academic achievement. Learning approaches were the reason of indirect affect and they mediated the relationship between epistemological beliefs and achievement. Cano also pointed out the continuous change in both epistemological beliefs and learning approaches during the secondary education. The results revealed that epistemological beliefs become less naive and simplistic, and more realistic and complex in time. Regarding gender, some differences in the change of epistemological beliefs were found. It was revealed that, boys' beliefs in quick learning are more unstable throughout secondary education. Beliefs in simple knowledge and in certain knowledge, however, follow a similar pattern in both boys and girls. The observed differences related with gender are insignificant and explain the small percentage of the variance. In addition to changes in epistemological beliefs, decrease in learning approaches in time was revealed. Observing this change according to gender indicated that learning approaches of boys and girls tend to differ in time although they were same at the beginning of secondary school. Surface approaches of junior high and senior high boys are higher than surface approaches of junior and senior high girls. But girls do not get higher scores than boys on deep approach, except in senior high. The differences in learning approaches depending on gender are, as of small magnitude.

In her study, Holschuh explored the relationship between epistemological beliefs and strategy use (deep vs. surface) of 518 freshmen, sophomore, junior, senior and graduate US college students. She also examined the dimensionality of epistemological beliefs, the effect of epistemological beliefs and strategy use on

academic performance. The participants were from two sections of a biology introductory course. All participants in her study completed five assessments including the Epistemological Questionnaire, the Epistemological Scenario, the Self-Regulated Inventory, two strategy checklists, and an open ended Questionnaire. According to the results, Holschuh (1998) reported a weak relationship between epistemological beliefs and strategy use. In her study, mature epistemological beliefs of students were indicating more deep approaches; more naïve epistemological beliefs of them were indicating more surface approaches. Moreover results revealed the affect of both epistemological beliefs and strategy use on academic performance, college GPA, and biology course grade. Holschuh concluded that mature epistemological beliefs and deep strategies of students were the sign of better performance.

Schreiber and Shinn (2003) explored the hypothetical relationship between epistemological beliefs and learning processes of 110 US community college students who were in their first year. The results indicated an association between epistemological beliefs and learning processes of those students. In that study, there was a negative relationship between fixed ability and Agentic processing, and positive relationship between elaborative processing and fixed ability. The results showed that students who believed that the ability to learn can improve, processed information in a serial fashion. And students who saw ability to learn as constant were less likely to process information intensely. The study also indicated that deep processors believed in the necessity of time for learning. On the other hand, learners who trusted in fixed ability realized that learning was a first time event that did not take extra time

In her study, Saunders (1998) investigated the possible relationships among students' epistemological beliefs and approaches to learning. She also examined the possible influence of teachers' implemented instruction on students' beliefs and learning approaches. She studied with five chemistry laboratory teachers and 232 college students from Midwestern part of America. She made the investigation through observing students' laboratory experiences and collecting data with two student

questionnaires. Saunders found that encouraging students and allowing them to be active led students to feel themselves as the source of scientific knowledge. On the other hand, teacher's presenting himself as an authoritative source of knowledge resulted in students' belief of teacher as the authority of knowledge. Results revealed that students who learned by less inquiry agreed that source of knowing was authority. Conversely, students who mostly learned by inquiry, believed in the importance of experimentation and logical reasoning for justification of knowledge. Investigating the subjects of that study, Saunders found that some students were having strong believes in received knowledge; however there wasn't any student holding strong believes in reasoned knowledge; and most students were having mid-range beliefs. In contrast, many students believed in personal scientific knowledge during the chemistry laboratories. As the results suggested, learning orientations found not correlated with learning and the type of instruction. Nevertheless, results revealed that students' perceptions of classroom tasks influenced their choice of learning strategies. In addition, belief in gaining knowledge from authorities predicted rote learning approach and memorization of information.

Chan (2003) investigated the relationship between epistemological beliefs and learning approaches of 385 Hong Kong preservice teacher education students. He also explored participants' epistemological beliefs and four dimensions. First of all, he found a positive correlation between innate/fixed ability and surface approach. However, no relation was found between innate/fixed ability and deep approaches. Authority knowledge was positively related to deep approach, but negatively related to surface approach. Certainty knowledge, on the other hand, was correlated positively only with surface approach. Author concluded that student's tendency to use deep approach was related with their belief that learning requires effort and a process of understanding. On the other hand student's tendency to use surface approach was related with those students naïve/unsophisticated epistemological belief that supports ability is fixed and innate. In addition to these, students who believed in authority knowledge seemed to try a surface approach instead of a deep approach, and those students who believed that knowledge is certain and unchanged were likely to use surface approach. In short, surface approach is dependent on the

beliefs that ability to learn is fixed, knowledge is controlled by authority and that knowledge is definite and unchanging. Deep approach, on the other hand, is connected with the belief that learning requires effort and a process of understanding and integration, that knowledge is acquired through one's reasoning rather than dispensed by authorities. Chan also established that the Hong Kong teacher education students tended to believe that knowledge is obtained by one's effort rather than belonging to the authority figures or experts. They also tended not to believe that ability is inborn and fixed; and they tended not to believe that knowledge is certain and unchanged. Chan related these findings with The Confucian Chinese culture which gives importance to education, effort and working, in addition associates education and learning with effort. People of that culture consider effort or hardworking important in person's success, especially in academic achievement. In traditional Chinese culture, it is assumed that authority figures or experts hand down knowledge which was related with their culture expecting respect, and being obedient, to elders and authority figures. This study also revealed the importance of culture in epistemological beliefs of preservice teachers.

In a later study, Chan and Elliott (2002) examined the epistemological beliefs of Hong Kong teacher education. In addition, they investigated whether there is any significant difference in epistemological beliefs of the teacher education students in terms of age, electives studied, and courses or not . They also aimed to compare the results with North America University and college students. Their study contained quantitative and qualitative methods. The participants of quantitative study were 385 Hong Kong teacher education students. The questionnaire they took was based around Schommer's 63-item epistemological beliefs questionnaire. The participants who took qualitative part of the study were 23 students from the quantitative study. They attended interviews voluntarily. They found four dimensions of epistemological beliefs which were similar with the finding of Schommer with North American students. Although the number of the dimensions was found to be the same with Schommers', their nature was different in two studies. The reason for different nature of dimensions was reported to be different cultural context.

All the studies mentioned above generally concluded that students with the sophisticated epistemological beliefs and meaningful learning orientation for learning were likely to perform better than those holding naïve beliefs or employing rote learning orientation.

Apart from epistemological beliefs and learning approaches, students' achievement motivation may affect their achievement. Achievement motivation involves students' goal orientations and self efficacy beliefs. The reason for some students perform better than others at acquiring knowledge about a new topic and engaging in tasks even when everyone was given the same instruction may be the goal orientations they have (DeBacker & Crowson, 2006; Pintrich & Schunk, 2002; Pintrich, 2000) Performance goal orientation and mastery goal orientation are two commonly investigated goal orientations. Performance goal orientation focuses on demonstrating normatively high competence or ability, looking for recognition of accomplishments, avoiding looking dumb, and avoiding performing poorly. Mastery goal orientation, in contrast to performance goal orientation, focuses on learning, understanding, mastering the task, and personal improvement (Ames, 1992; Dweck, 1986; Nichols, 1984; Pintrich & Schunk, 2002). Students with mastery goal orientation are more likely to show effort and persistence in their academic work and use various learning strategies and processing information deeply (Ames & Archer, 1988) On the other hand, students with performance goal orientations needs to demonstrate their abilities and compete with others (e.g., Silva & Nicholls, 1993). They also enjoy demonstrating their abilities, receiving praise from their peers, teachers, and parents. They also avoid negative judgments (e.g., Meece et al., 1988).In addition to goal orientations; students' self efficacy has similar outcomes of mastery goal orientation. Self efficacy of students is found to be positively related to deep approaches to learning, more persistence and effort (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Bandura, 1993; Hoy, 2004). Bandura (1986) defined self efficacy as personal judgments about ones own ability to learn or perform at a special level on a particular task. Students with higher levels of self-efficacy find difficult tasks challenging to be mastered. They set up challenging goals, put their effort forth to accomplish them, and use various strategies. On the other hand, students with

lower levels of efficacy are likely to give up easily in the face of difficulty and keep away from being involved in the task (Pajares, 1996). Indeed, Bandura (1993) suggested that students' motivation including their self-efficacy is related to the use of learning strategies that influence academic achievement. In their study, Walker, Greene, and Mansell, (2006) examined relations among motivational characteristics of students that are malleable, or changeable with intervention. Students perceptions of belonging and valuing within an academic context, was investigated along with intrinsic/extrinsic motivation, and self-efficacy as a predictors of cognitive engagement. The subjects of the study were 191 college students from a Southwestern Univesity.They concluded that knowing a student's level of academic identification can provide unique information in terms of academic performance that cannot be accounted for solely by intrinsic/extrinsic motivation or perceptions of competence in a domain. While intrinsic motivation, self-efficacy, and identification with academics all contributed unique variance to predicting meaningful cognitive engagement, extrinsic motivation was the only variable that predicted shallow cognitive engagement. They found a positive relationship between students' self-efficacy and meaningful cognitive engagement. In a separate study, Sungur (2007) showed the relationships among motivational beliefs, metacognitive strategy use, and effort regulation of 391 Turkish high school students in their science course on a path model. The results of her study revealed that intrinsic goal orientation, beliefs about value of a task, control of learning beliefs, and self-efficacy for learning and performance were predictors of students' metacognitive strategy use. In addition, effect of motivational beliefs on effort regulation was mediated through metacognitive strategy use. Her model revealed interrelationships among motivational beliefs. It was concluded that students should have motivation to use metacognitive strategies and engage in a task. In another study, Wolters (2004) examined the relations between 434 seventh and eighth grade students' three goal orientations, motivational beliefs and self-regulated learning in three areas: English, Math and Social Studies. The results of his study revealed that having learning goal orientation and relative ability goal orientation resulted in a generally positive pattern of motivational beliefs. Results also showed that extrinsic goal orientation led to more maladaptive motivational and cognitive outcomes. Ames and Archer (1988)

found that students who have mastery goal orientations used more effective strategies, choose more challenging tasks, have positive attitudes toward the class and believe in the importance of effort for being more successful. On the other hand, students who have performance goal orientations tend to find a relationship between success and their abilities. In addition, they evaluate their ability negatively; find themselves without ability and see that lack of ability as the reason for their failure.

In their study, Meece, Blumenfeld, and Hoyle, (1988) assessed 275 fifth and sixth grade American students' goal orientations and their use of high-level or effort-minimizing learning strategies in order to test the goal mediational model. This model was for conceptualizing the complex influence of individual and situational variables on students' goals and engagement patterns in the classroom. According to the results, students with higher learning goal orientations were engaged more actively and cognitively. On the contrary, students with performance goal orientations were less cognitively engaged. The results of their study also revealed the importance of strength of these goals which determine students' intrinsic motivation and attitudes toward science.

Wolters, Yu, and Pintrich, (1996) found a positive relationship between performance approach goal orientation and use of deeper cognitive strategies in their study with 434 seventh and eighth grade students from a junior high school in America. In contrast, Kaplan and Midgley (1997) found a positive relationship between performance approach goal orientation and surface approaches to learning by studying with 229 seventh grade students in two middle schools in the same school district in southeastern Michigan in America.

Learning is influenced not only by task specific goals and perceptions but also by domain-specific values. DeBacker and Nelson (1997) showed the effect of task specific and domain specific goals and importance of gender differences in science class. In their study they investigated motivation differences of high school students concerning their science class type, gender, and capability. The results revealed that students who found science valuable, had high perceived ability in science, and who

did not have gender stereotyped views of science were likely to pursue learning goals in science class. In addition these students had desire to express their competence and please their science teachers in science class. On the other hand, students with more stereotyped views of science were less likely to follow learning goals in science class, to identify science as related to future goals, or to value science attainment or utility. Stereotyped views of students were not related with their intrinsic valuing meaning that students having stereotyped views of the science field may have intrinsic satisfaction. The results indicated that high perceived ability, learning goal, intrinsic value, and attainment value provided optimism and persistence of students during learning. In this study, there was a group of students who were having high perceived ability, conversely there were students who were externally focused, having performance goals, desire to please teacher, and perceived instrumentality. According to the results, higher ability students, physical science students, and male students had higher perceived ability than lower ability students, students in biological science and female students, respectively.

In addition to the above findings, literature revealed that motivation may change according to students' grade level. In their study, Otis, Grouzet, and Pelletier, (2005) examined changes in intrinsic and extrinsic motivation during the transition from junior to senior high school and the impact of motivational changes on various educational consequences such as dropout intentions, absenteeism, and homework frequency. The results revealed regular decrease in students' intrinsic motivation and extrinsic motivation while passing from 8th to 10th grade. Furthermore, students experiencing a decline in external regulation and intrinsic motivation during the transitional year were observed to be less adjusted to education and these students identified regulation during the year after the transition. In a different study, Lepper, Corpus and Iyengar (2005) examined age differences in intrinsic and extrinsic motivation and the relationships of each to academic outcomes in an ethnically diverse sample of 3rd-grade through 8th grade children. The results indicated a moderate correlation between intrinsic and extrinsic motivation of students. In addition, results revealed a significant linear decrease in intrinsic motivation from 3rd grade through 8th grade and proved positive correlation with children's grades and

standardized test scores at all grade levels. On the other hand, extrinsic motivation showed few differences across grade levels. Its negative correlation with academic outcomes was also revealed.

As mentioned before, achievement motivation not only involves goal orientations of students but also, involves their self efficacy beliefs. Self-efficacy beliefs of students may increase student engagement and learning in the classroom. Students who have positive and relatively high self-efficacy beliefs were more likely to be involved in the classroom in terms of their behavior, cognition, and motivation. (Linnenbrink & Pintrich, 2003). In his article, Pajares **(**2003) examined the research findings that address the relationship between writing self-efficacy, other motivation constructs related to writing, and writing outcomes in academic settings. As well as affecting various writing outcomes, he concluded that students' confidence in their writing capabilities influence their writing motivation. Judgments of personal efficacy affect what students do by influencing the choices they make, the effort they expend, the persistence and perseverance they exert when obstacles arise, and the thought patterns and emotional reactions they experience. For example, a strong sense of confidence brings greater interest and attention to writing, stronger effort, and greater perseverance and resiliency despite the obstacles. Confident students are also likely to feel less anxious and they respect their writing.

Student self-efficacy is naturally changeable. The contextual features of the classroom affect these beliefs and teachers can increase students' self-efficacy level. Teachers can design and organize their instruction to have a positive impact on student self-efficacy and, in turn, on student involvement and learning in the classroom. Regarding all these, in their article, Linnenbrink and Pintrich (2003) made some suggestions for all teachers in order to increase the self efficacy levels of students. Firstly, they offered to provide students with relatively high but accurate self-efficacy beliefs as students are motivated to be involved in tasks and accomplish when they believe they can. Secondly, they offered to use challenging academic tasks that most students can reach with effort. Thirdly, they offered teachers to encourage the belief that competence or ability is a changeable and controllable.

And finally they offered to promote the students' domain specific self-efficacy beliefs instead of global self-esteem.

In accordance with these suggestions**,** Susskind (2005) examined the effects of non-interactive computer assisted instruction on students' performance, self-efficacy, motivation, and attitudes. The results implied that lectures supplied with PowerPoint presentations did not significantly affect student achievement. Although the PowerPoint lectures were perceived as more organized and easier to understand, they did not improve the students' performance on exams. However, students had positive attitudes and self-efficacy beliefs when PowerPoint was used in lectures. Students claimed PowerPoint lectures as more organized emphasizing the main points well. This opinion impacted the students' self-efficacy beliefs that they believed it was easier to follow and understand the PowerPoint lectures, to take notes, and to organize, understand, and use those notes. In addition, the students consider the classes with PowerPoint as more interesting and entertaining. In contrast, there wasn't any change in students' motivation that received traditional instruction first and then received lectures with PowerPoint However, motivation of students who were initially taught with PowerPoint and then received traditional lectures decreased during the traditional lecture design.

In their study with159 Korean seventh grade students, Kang, Noh, Scharmann and Koh (2005) investigated the relationships among students' cognitive/motivational variables, cognitive conflict, and conceptual change. First of all, they conducted tests regarding logical thinking ability, field dependence/independence (FDI), meaningful learning approach, failure tolerance, mastery goal orientation, and self-efficacy in order to examine those students' cognitive/motivational characteristics. In addition, they conducted a preconception test and a test of responses to discrepant event in order to examine the degree of students' cognitive conflict induced by a discrepant event. Next, they provided computer-assisted instruction to students for changing weight-density concept into a scientific density concept. After the instruction, they administered a conception test. According to the results, the majority of the variables showed significant correlations with the conception test scores; however, mastery

goal orientation couldn't reveal a significant correlation. The results revealed that logical thinking ability, FDI, and failure tolerance were statistically significant predictors of the variance of the conception test scores. Logical thinking ability was the main predictor of achievement in conception test. According to the regression analyses, meaningful learning approach, mastery goal orientation, and self-efficacy were not found to be significantly related to the conception test scores. The researchers explained the reason of nonsignificant relationship between goal orientation, self-efficacy and conception test scores by the situation-specific specialty of goal orientation and self efficacy.

Some research showed the association between achievement goals and self efficacy. For example, in their study, Shim and Ryan (2005) examined the relationship between achievement goals and changes in students' self-efficacy, challenge avoidance, and intrinsic value in response to grades of college students. The study showed the importance of achievement goals around getting grades as they lead to changes in motivational constructs. For instance, when students received high grades, a performance-approach goal was unrelated to changes in self-efficacy; desire to avoid challenge, or intrinsic value. However, when students received low grades, a performance-approach goal was connected with decrease in intrinsic value and increase in keeping away from challenge. Considering the mastery goals of students, these goals support self-efficacy and prevent challenge avoidance even in the context of low grades. On the other hand, a performance- avoidance goal is related to decreased motivation even in the context of high grades. Greene, Miller, Crowson, Duke and Akey (2004) showed that self-efficacy and mastery goal orientation significantly predicted the strategy use and considerable research indicates that use of self regulated learning strategies (metacognitive and deep cognitive) are highly related to quality of learning, performance, and positive academic outcomes (Hwang & Vrongistinos 2002; Pintrich & DeGroot 1990; Pintrich & Garcia 1991; Zimmerman & Martinez-Pons 1986).

As far as the relationship between achievement motivation and epistemological beliefs are considered, some studies revealed association between these variables.

For instance, Paulsen and Feldman (1999) demonstrated statistically significant relations between dimensions of epistemological beliefs (simple knowledge, quick learning, and fixed ability) and motivational constructs (intrinsic goal orientation, extrinsic goal orientation, task value, control of learning, self-efficacy, and test anxiety)by examining 502 undergraduate students at a large urban public university in US. The authors reported that, compared to students who believe that the structure of knowledge is complex; students who believe that the structure of knowledge is simple were less likely to have an intrinsic goal orientation, to find learning tasks significant, to manage his/her learning and to believe in their learning capacity. Students with the naïve belief in simple knowledge were also more likely to have an extrinsic goal orientation and to experience higher levels of test anxiety than their peers having more sophisticated beliefs. Comparing two groups having two different epistemological beliefs, it was revealed that students with the naïve belief and accepted quick learning were less likely to have an intrinsic goal orientation, to value the learning tasks, to have an internal control over learning than students with the more sophisticated beliefs and accepted gradual learning. Students who believed that the ability to learn is fixed were less likely to have intrinsic goal orientation, to appreciate learning, to perceive an internal control over learning and to feel efficacious about their capacity to learn than their peers with more sophisticated belief and believe in the improvement of ability to learn. Their study, however, couldn't reveal a statistically significant relationship between motivational constructs and certain/tentative knowledge. Possible associations between students' beliefs, achievement motivation, and learning outcomes were illustrated in Buehl's (2003) model. Buehl hypothesized that epistemological beliefs of students have direct affect on students' achievement motivation and cognitive processing (strategy use). Buehl's model also proposed that learners' epistemological beliefs are indirectly associated with their achievement and academic performance by affecting students' motivation, cognitive processing, and strategies they use at the learning situation (e.g., effort and persistence). Buehl supported his model by reviewing the literature. Accordingly, he claimed that a belief in fixed ability was related to lower levels of learning goals. Similarly, students' who believed that success does not require hard work also tended to support task goals less than students who thought that hard work and effort

are necessary to succeed. In that case, students' epistemological beliefs affected their academic achievement. Buehl also emphasized the relationships between other aspects of students' epistemological beliefs (e.g., beliefs about the structure of knowledge) and goal orientations. Accordingly, he indicated the positive relationship between students' belief about simplicity of knowledge, extrinsic goals and negative relation between beliefs about simplicity of knowledge and intrinsic goals. In his model, it was revealed that students who viewed knowledge as more simplistic and isolated tended to achieve in order to receive external praise and rewards, while students' who viewed knowledge as complex and interrelated engaged in tasks in order to please their own interests and desires. Buehl also claimed that students' judgments about their abilities to succeed at a learning task are likely to be based on their conceptions or misconceptions of knowledge and its acquisition. According to Buehl, as students form their efficacy beliefs, they may compare their beliefs about knowledge and what is needed to do well in acquiring that knowledge against their perceptions of their own abilities. In his model Buehl also indicated the relationship between students' beliefs about knowledge and their competency beliefs, processing, and tactics they employ at the learning situation. He finally mentioned the importance of culture in his model which permeates beliefs and behaviors of people.

Murphy, Buehl, Monoi, and Long (2002) stated the possibility of relationship between some aspects of students' epistemological beliefs, (quick learning and innate ability) to their goal orientations. Accordingly, authors examined the relationship between 8th and 9th grade students' beliefs about knowledge, goal orientation and academic performance. They found that students' beliefs about integration of knowledge were positively correlated with their learning goals and negatively correlated with their performance-avoidance and work-avoidant goals. It was concluded that different dimensions of epistemological beliefs were likely to have different relations with students' motivation.

In a later investigation in a college physics course, Cavallo et al. (2004) investigated the predictive influences of learning approaches, motivational goals, self-efficacy,

epistemological beliefs, and reasoning ability on physics concept understanding and course achievement. According to the results, there were positive correlations between learning goals and meaningful learning, and between rote learning and performance goals. In their study, self-efficacy was a significant predictor of students' physics understanding and course achievement. Regarding learning goals, the study revealed different results according to gender. Learning goals were negatively correlated with performance goals for females but not for males. Learning goals and rote learning were found to be significant predictors of achievement and understanding for male students but in a negative direction. On the other hand, performance goals and rote learning were negatively correlated with tentative science beliefs.

Kang and Wallace (2004) explored the use of laboratory activities of three experienced secondary science teachers in order to find out the affect of their epistemological beliefs and teaching goals on using those activities. Ontological aspect (certainty/diversity of truth) and relational aspect (relationship between the knower and the known) of epistemological beliefs guided their study and the results demonstrated that a teacher's naive epistemological beliefs were clearly reflected in the teacher's teaching practices. However, a teacher's sophisticated epistemological beliefs were not always clearly connected to the practice. Ontological and relational beliefs seemed to be connected to different facets of teaching practices. Findings indicated linkage between teachers' diverse ways of using lab activities and various syntheses of different aspects of epistemological beliefs and instructional goals. Their study supported the view of epistemological beliefs as a multidimensional construct. The study suggested assistance of multiple directions including ontological and relational aspects for developing the sophisticated epistemological beliefs of teachers. Moreover, it suggested discussing epistemological beliefs in connection with instructional goals and teaching.

Regarding the affect of relationship between preservice teachers' motivation and epistemological beliefs, several studies were conducted. In their study, Ravindran, Greene, and De Backer, (2005) examined relationships among achievement goals,

epistemological beliefs, cognitive engagement, and application learning of preservice teachers. Results revealed the importance of goals and beliefs in predicting meaningful and shallow cognitive engagement. Application learning was significantly predicted only by shallow cognitive engagement negatively. In addition, results revealed a positive relationship between learning, performance goals and cognitive engagement; learning goal explained meaningful learning scores and performance goals explained shallow engagement scores. Moreover, shallow learning and shallow learning strategies were found to be related with naïve beliefs about authority. The results suggested correlation between performance goals, innate capacity to learn and simple knowledge indicating that students who completed academic tasks to demonstrate high ability or outperform their classmates also believed that capacity to learn is innate. Correlations also showed that epistemological beliefs had theoretically consistent associations with students' cognitive engagement. Shallow processing related positively to each of the naïve epistemological beliefs indicating that students who engaged in shallow processing tended to believe that the structure of knowledge was simple, the content of knowledge was certain, and knowledge can be acquired quickly from omniscient authorities. The results did not show any relation between meaningful cognitive engagement and epistemological beliefs except illustrating a moderate negative relationship with omniscient authority

In addition to the above studies in the related literature, there are some studies which were conducted in Turkey. In her study, Çalışkan (2004) investigated the effects of inquiry-based high school chemistry course and gender differences on ninth grade students' understanding of atom concept, learning approaches, motivational goals, self-efficacy, and epistemological beliefs (n= 47). In her study Çalışkan used Chemistry Achievement Test (CAT), Learning Approach Questionnaire (LAQ), Achievement Motivation Questionnaire (AMQ), and Science Knowledge Questionnaire (SKQ) in order to measure students' meaningful learning, rote learning, learning-goal orientation, performance-goal orientation, self-efficacy and epistemological beliefs. In that study, there were two groups of students according to the type of instruction they took. One group of students learned atom concept with

inquiry based instruction and other group took traditional instruction. According to the results, it was revealed that the students who used the inquiry oriented instruction had significantly higher scores with respect to achievement related to atom concept than the students who had traditional designed chemistry instruction. It was also found that, inquiry oriented instruction did not effect students' learning approaches, motivational goals, self-efficacy, and epistemological beliefs.

In a separate study, Yenilmez (2006) investigated the relative predictive influences of prior knowledge, meaningful learning, formal reasoning ability and mode of instruction on understanding in photosynthesis and respiration in plants concepts. Her subjects were 238 8^{th} grade students from six classes of one elementary school. The students were divided into two groups as experimental group (N=117) and control group (N=116). Students in the experimental group received conceptual change instruction, and students in the control group had traditional instruction. Conceptual change instruction results in meaningful learning by allowing learners to realign reorganize and replace their existing misconceptions. New ideas are easily accommodated and misconceptions are decreased by this instruction. The results of the study indicated significant differences between the experimental group and control group with respect to understanding of the concept in favor of experimental group. In that study formal reasoning ability was the main predictor of performance on the posttest in traditional classrooms, however, the main predictor of the performance on post-test in conceptual change classrooms was students' prior knowledge. Accordingly, the results revealed that students with higher reasoning ability had greater understanding of the concepts of photosynthesis and respiration in plants and their prior knowledge has great influence on their further learning. In Yenilmez's study; meaningful learning orientation was also a predictor of concept understanding of photosynthesis and respiration in plants in conceptual change classrooms, explaining 3.7% of the variance.

In another study, Atay (2006) explored relationships among 213 8^{th} grade elementary school students' gender, relevant prior knowledge, meaningful learning orientation, reasoning ability, self-efficacy, locus of control, attitudes toward science and

achievement in genetics in learning cycle and traditional classrooms. Similar with the study of Yenilmez, there were two groups of students in this study: Experimental group (N=104) which received learning cycle instruction (Learning Cycle provides students conceptual understanding of scientific concepts) and Control group (N=109) which received traditional instruction. The students were given Genetics Achievement Test as a pre-test before and as a post-test after the instruction. The results showed the, positive effect of learning cycle instruction on students' achievement in genetics concepts compared to traditional instruction. In addition, meaningful learning orientation (49.6%), attitudes toward science (11.8%) were found to be significant predictors of achievement in genetics in learning cycle classrooms. In traditional classrooms, students' attitudes toward science (44%) and reasoning ability (9.8%) were the main predictors of achievement. The remaining 5.7% of the variance was belonged to the relevant prior knowledge, locus of control and meaningful learning orientation of students. In addition to these, even though the results revealed a positive correlation between self-efficacy and genetics achievement, self-efficacy failed to predict genetics achievement in both traditional and learning cycle classrooms. In short, her study revealed the importance of different variables for 8th grade students' genetics achievement in learning cycle and traditional classes.

In general, review of related literature has showed significant correlations between students' epistemological beliefs, learning approaches, motivation and science achievement.

CHAPTER 3

METHOD

In the following chapter, population and sampling, description of variables, instruments of the study, procedure and methods used to analyze data and assumptions and limitations will be explained briefly.

3.1 Design of the study

The research design of this study is Correlational Design. Possible relationships among epistemological beliefs, learning approaches, achievement motivation and science achievement were investigated in order to predict the hypothesis for this study.

3.2Population and Sample

All sixth grade elementary school students in Ankara were identified as the target population of the study. However, it is appropriate to define an accessible population since it is not easy to reach the target population. The accessible population was determined as all sixth grade students from Çankaya district of Ankara. This is the population which the results of the study will be generalized. The population being sampled in this study was 10076 students according to the Directorate of National Education in Ankara. This population is composed of all sixth grade students attending public schools in Çankaya district. Accordingly, the desired sample size was determined as 1007 students, which is 10% of the whole population. Cluster random sampling was used to obtain representative sample. Schools which were thought as clusters were randomly selected from Çankaya district. Currently, there

are 101 schools in the district. For this study, 11 schools were selected randomly and tried to reach all sixth grade students in each school. An average of 50-75 students per school was participated in the study. The sample consisted of 1041 (507 girls, 534 boys) sixth grade students, aged between 11 and 12 years, attending 11 public elementary schools in Çankaya district of Ankara.

3.3 Variables

There are six variables involved in this study, which are categorized as dependent and independent variables. There is one dependent variable (DV) and five independent variables (IVs).

3.3.1 Dependent Variable

The dependent variable of the study is students' science achievement test mean scores as measured by Classification Concept Test.

3.3.2. Independent Variables

The independent variables included in the study are, students' learning approaches, learning goal orientations, performance goal orientations, self efficacy beliefs, and their epistemological beliefs. Learning approaches, learning goal orientations, performance goal orientations, self efficacy beliefs, and epistemological beliefs are continuous variables.

3.4 Data Collection Instruments

In this study four instruments were used in order to obtain data from students. These are the Turkish versions of Achievement Motivation Questionnaire (AMQ), Epistemological Beliefs Questionnaire (EBQ), Learning Approach Questionnaire (LAQ), and Classification Concept Test (CCT).

3.4.1 Achievement Motivation Questionnaire (AMQ)

The AMQ is a 14-item Likert instrument consisting of three sub-scales regarding motivation to learn in the science course: Learning goal orientation (LG; e.g., ”One of my goals in this class is to understand the material that we study”), performance goal orientation (PG; e.g., ”One of my primary goals in this class is to do better than other students”), and self efficacy (SE; e.g.,” I am confident I can do well on the science problems we are given in this class”), (see appendix A). A high LG score indicates high desire to learn for the sake of learning; a high PG score indicates a high desire to achieve high grades; and a high SE score indicates a high self efficacy or confidence in ability to learn science. The questionnaire was translated and adapted into Turkish by Çalışkan (2004).

For this study, the cronbach alpha reliability calculated is r=.82 for learning goals, r=.76 for performance goals and r=.54 for self efficacy.

3.4.2 Epistemological Beliefs Questionnaire

Epistemological Beliefs Questionnaire used in this study is a 26-item Likert instrument (Conley et al., 2004) measuring students’ epistemological beliefs about the nature of science along four dimensions: Source, certainity, development and justification. Items were rated on a 4-point Likert scale (1= Strongly disagree; 4= Strongly agree), and all questions were worded to have students focus on the domain of science (see appendix B).Source was concerned with beliefs about knowledge residing external authorities (e.g., “Whatever the teacher says in science class is true”). Certainity referred to a belief in a right answer (e.g., “All questions in science have one right answer”). Development measured belief about science as an evolving and changing subject (e.g., “Sometimes scientists change their minds about what is true in science”). Justification was concerned with the role of experiments and how individuals justify knowledge (e.g., “Good answers are based on evidence from many different experiments”). In order to calculate students’ epistemological beliefs as one total score, their answers to the source and certainity dimensions were

reversed and these reversed scores added to justification and development scores. For this study, students' science beliefs range from a view of science as fixed and authoritative (low score) to a view of science as tentative and dynamic (high score). The questionnaire was translated and adapted into Turkish by Kaynar (2007). For this study, the cronbach alpha reliability was found to be r= .76.

3.4.3 Learning Approach Questionnaire (LAQ)

Learning Approach Questionnaire (LAQ), developed by Cavallo (1996), is a 22 item Likert instrument which measures students' approaches to learning as meaningful or rote(See appendix C). On this questionnaire students are asked to respond each item by using 4-point Likert scale (1= strongly disagree to 4= strongly agree). A high score indicates students have high meaningful learning approach; and a low score indicates students have high rote learning approach. The questionnaire was translated and adapted into Turkish by Yenilmez (2004).
For this study, the Cronbach alpha internal consistency was calculated as r=.71

3.4.4 Classification Concept Test (CCT)

The Classification Concept Test was developed by the researcher to asses students' achievement in classification concepts (See appendix D). It is consisted of 15 multiple-choice questions. Each question had one correct answer and three distracters. During the developmental stage of the achievement test, instructional objectives related to classification concepts were determined by taking the national science and technology curriculum and fifth grade Science and Technology Textbook (Keskin, Özkan, Uysal, Adıgüzel, Yenilmez, Özdemir, & Aydın, 2005) into consideration. The content validity and clarity of each item in the test were determined by a panel of four science teachers and two science educators. The science teachers also analyzed the relatedness of the test items to the instructional objectives. They confirmed that the content validity of the instrument was appropriate for the participants and determined that the CCT was valid with respect to the constructs measured. Prior to the administration, CCT was pilot tested with a

sample of 57 sixth grade students from one of the selected schools. According to the results of the pilot study, the questions in the tests were reorganized and some words and questions were changed according to the level of these students. Internal reliability was calculated as r= .60.

3.5 Procedure

Defining the research problem specifically and formulating the search terms pertinent to the problem of interest was the first step of the study. Then, the related literature was reviewed in detail from Educational Resources Information Center (ERIC), internal Dissertation abstracts, Ebscohost, Social Science Citation Index (SSCI), and Science Direct. Photocopies of available documents were obtained form METU Library. The researcher read all the relevant documents and organized them.

After a detailed literature review, measuring instruments were prepared. After the selection of schools which will be involved in the study, necessary permission for the administration of the measuring instruments was taken from the Ministry of Education

In October 2006, AMQ, EBQ, LAQ and CCT were pilot tested with a sample of 57 sixth grade students from one representative school. The researcher analyzed and evaluated the results of the pilot study.

All measuring instruments were administered by the researcher to 1041 students from 11 selected schools during 5 weeks in October and November 2006. All participants completed the tests in two class hours. Before the administration of tests, necessary information was given by the researcher or the teacher. The researcher/teacher made students sure about the confidence of the tests that the answers collected from them would be held in confidence and that the scores of the CCT would not affect their science grades. The importance of completing all the tests without leaving any item empty was explained by the researcher/teacher as well.

Researcher was present in nearly all administrations but sometimes due to the time restriction, the researcher requested teacher support. Before the administration of tools, the teachers were informed about the purpose of the study, about the directions that should be done. There weren't any specific problems during the administration.

3.6 Analysis of Data

SPSS (Statistical Package for Social Sciences) was used in analyzing the data collected. Sample's general characteristics are investigated as descriptive statistics and the means, standard deviations, percentages and histograms of variables are presented under the corresponding research questions.

Pearson Correlation Analysis, Multiple Regression Analysis and Stepwise Regression Analyses are conducted in order to investigate the possible relationships among variables. The level of significance of all measures was defined as p=0.05.

3.7 Assumptions and Limitations of the Study

Several considerations may affect the overall findings of a research study, or effective usefulness of the results. Following assumptions and limitations identify both positive and negative aspects of the basic study's design and serve to enrich the conclusions of this study.

3.7.1 Assumptions of the Study

Following are the assumptions for this study:

1. All conditions were standard during the administration of the instruments.

2. The students of the pilot study were assumed to have approximately the same characteristics as the actual subjects of the study.

3. Comfort of the students and reducing the fear of personal exposure would be important in increasing the reliability of self-report measures. Students did not write their names on their questionnaires and the researcher gave numbers to the papers in order to ensure anonymity. This would lead to more comfortable atmosphere for the students while answering the questions.

4. Optimum cooperation of subjects and school personnel was ensured prior to test administration.

5. There was cooperation between all the teachers and the researcher in a peaceful atmosphere, as they were able to support educational research. Therefore, teachers were expected to be sincerely involved in the study.

6. All students involved in the study responded sincerely and correctly to the items of the LAQ, EBQ, AMQ and CCT.

7. The researcher who administered the survey did not influence the students' responses while they were completing the survey.

3.7.2 Limitations of the Study

1. The subjects of this study were limited to 1041 sixth grade students.

2. The research findings were limited to classification of living things concept.

3. This study was limited to public schools in Çankaya district.

4. The study was limited by its reliance on self-reported data.

5. The survey totally had too many items so that it might be too long for the students.

6. This study was limited to the information provided from the questionnaires. There was no qualitative research in the study.

7. Epistemological beliefs were examined in one dimension, although there are four dimensions which explain this variable totally.

3.8 Problems and Hypotheses of the Study

3.8.1 Main Problem

The main purpose of this study is to explore predictive influence of' epistemological beliefs, learning approaches, achievement motivations on sixth grade elementary students' achievement in classification concepts.

3.8.2 Sub-Problems and Hypothesis

1. What do 6th grade students know about classification concepts?

2. What are sixth grade students' epistemological beliefs?

3. What are sixth grade students' learning approaches?

4. What are the students' achievement motivations?

5. What are the possible relationships among 6th grade students' learning approaches, epistemological beliefs, achievement motivation and their achievement in classification concepts?

Hypothesis 1: There will be no significant correlations among students' learning approaches, epistemological beliefs, achievement motivation and their achievement in classification concepts?

6. What are the contribution of students' learning approaches, epistemological beliefs and achievement motivation on their achievement in classification concepts?

Hypothesis 2: There will be no contribution of students' learning approaches, epistemological beliefs and achievement motivation on their achievement in classification concepts?

7. Which variable best predicted 6th grade students' achievement in classification concepts?

CHAPTER 4

RESULT

4.1. Introduction

In this chapter the results of the analyses which were computed to answer the research questions are presented. There are two examination parts for research questions. In Part I, the research questions related with the general characteristics of the sample are addressed. In Part II, the associations between variables of the current study is investigated.

4.2. PART I: General characteristics of the sample

In Table 4.1 the instruments used, the possible and actual ranges, and the corresponding means and standard deviations gathered from the sample to address above mentioned questions are summarized.

Table 4.1. Descriptive Statistics for the Variables of the Study

Variable	Instrument	Mean	Standard Deviation	Possible Range	Actual Range	Skewness	Kurtosis
Achievement	CCT	7.9	2.64	0-15	0-15	-,12	-.45
Learning Approach	LAQ	64.51	7.92	22-88	36-86	-.27	-.10
Epistemological Beliefs	EBQ	76.03	7.49	26-104	27-104	-.64	2.27
Learning Goal Orientation	AMQ	17.14	2.79	5-20	5-20	-1.74	4.05
Performance Goal Orientation	AMQ	13.95	3.4	5-20	5-20	-.30	-.54
Self Efficacy	AMQ	10.94	1.6	4-16	4-16	-.158	.56

4.2.1. Research Question 1:

What do 6th grade students know about classification concepts?

The instrument "Classification Concept Test (CCT) is used for determining students' achievement in classification of living things. For this test, scores of students could range from 0 to 15. The mean score was 7.95 (Figure 4.1).

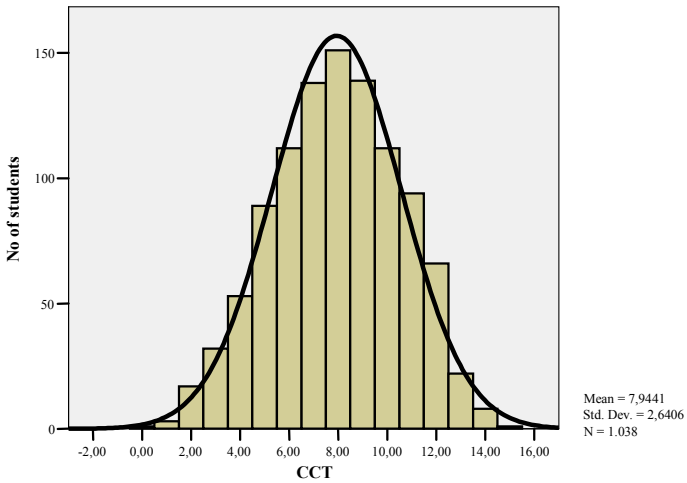

Figure 4.1 Range of CCT scores

According to figure 4.1, the CCT revealed a normal distribution of scores implying an average level of knowledge about the concept**.**

Frequency of students is summarized on Table 4.2 according to the scores they gained. All the questions were answered correctly by only one student out of 1041.

Table 4.2. Frequencies and percentages of correct responses on the CCT

Score	**F**	**(%)**
0	1	(.1)
1	3	(.3)
2	17	(1.6)
3	32	(3.1)
4	53	(5.1)
5	89	(8.6)
6	112	(10.8)
7	138	(14.5)
8	151	(14.5)
9	139	(13.4)
10	112	(10.8)
11	94	(9.1)
12	66	(6.4)
13	22	(2.1)
14	8	(.8)
15	1	(.1)

4.2.2. Research Question 2:

What are sixth grade students' epistemological beliefs?

Epistemological beliefs of students were measured by Epistemological Beliefs Questionnaire (EBQ). The students' epistemological beliefs differ from a view of science as fixed and authoritative (low score) to a view of science as tentative and dynamic (high score). Higher scores in the EBQ indicate higher tentative beliefs. For the present study, Table 4.3 shows the distribution of students according to the scores they got from EBQ. It suggests a normal distribution of the scores with a mean of 76.03.

This result can also be seen on figure 4.2.The possible range for the test was 26-104. The actual range was 27-104. The results suggest that the students in current study generally have tentative epistemological beliefs.

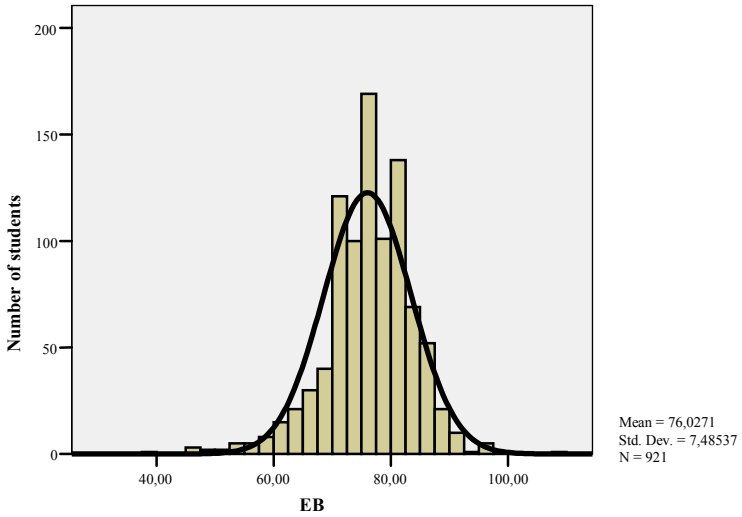

Figure 4.2. Range on EBQ

4.2.3. Research Question 3:

What are sixth grade students' learning approaches?

In the measurement of students' approaches to learning as meaningful or rote the Learning Approach Questionnaire (LAQ) is used (Cavallo, 1996). The means and standard deviations are summarized on Table 4.1. LAQ has a possible range of 22-88.

The actual range was 36-86.For this test, the higher the students' scores, the more meaningful learning approaches they have. The results revealed the mean of 65.00 which indicated that the students in recent study use meaningful learning orientation more than rote learning orientation. (See Figure 4.3.)

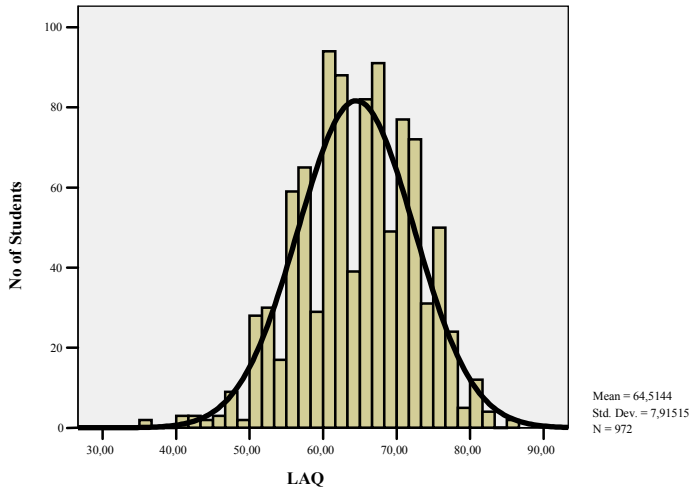

Figure 4.3. Range on LAQ

4.2.4. Research Question 4:

What are sixth grade students' achievement motivations?

In this study, students' learning goal orientation (LGO), performance goal orientation (PGO), and self efficacy (SE) are measured with AMQ .A high LGO score indicates high desire to learn for the sake of learning; a high PGO score indicates a high desire

to achieve high grades; and a high SE score indicates a high self efficacy or confidence in ability to learn science. Table 4.4. summarizes the means and standard deviations on the three subscales.

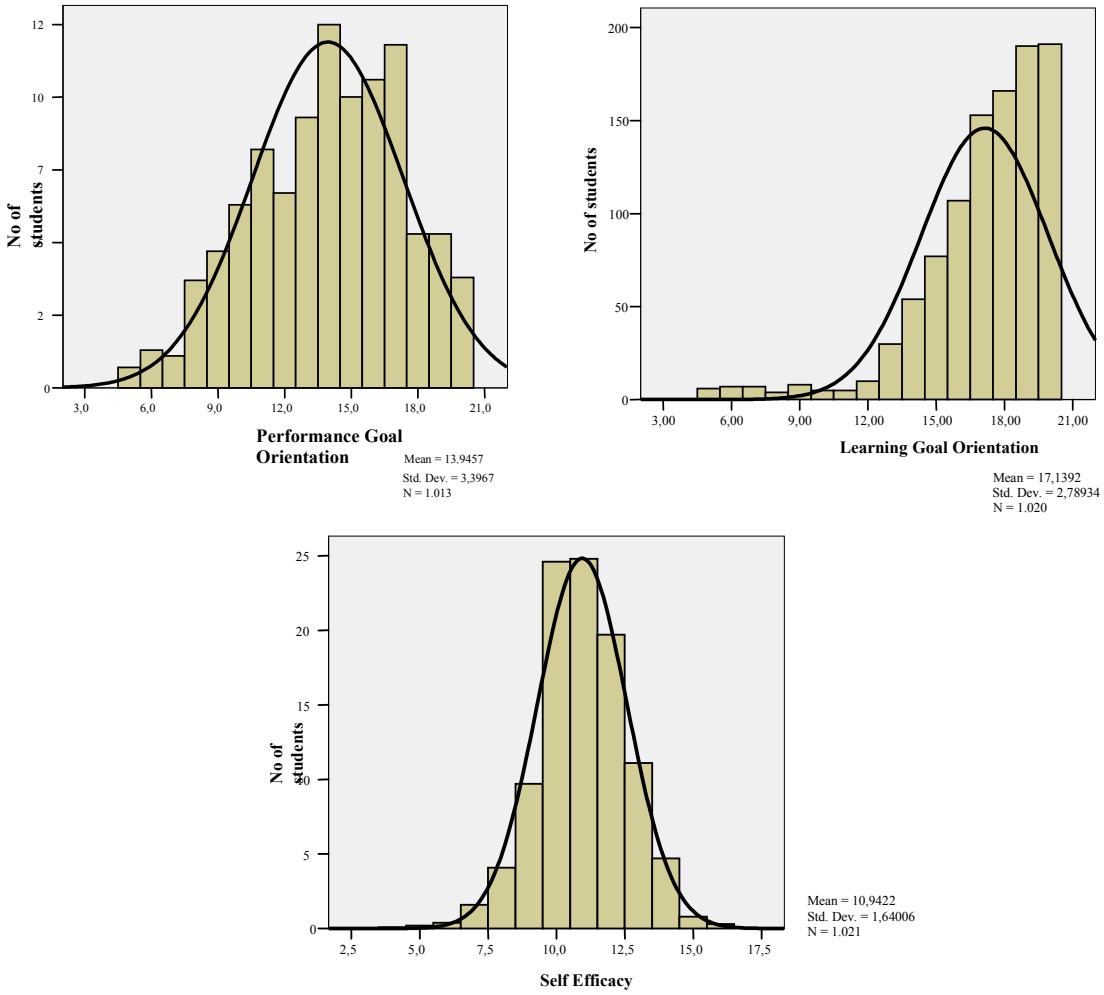

Figure 4.4. Range on PGO, LGO and SE.

Possible ranges and actual ranges of PGO and LGO scales were same, which are 5-20. In addition, possible range for SE scale is 4-16 and actual range was equivalent with the possible range. The mean for learning goal orientation (*M*=17.14) is higher than the mean of performance goal orientation (*M*= 13.95). This indicates that,

students in this study have higher learning goal orientations than performance goal orientations and they learn for the sake of learning rather than for high grades. The mean of SE score in current study was 10.94 .This implies that students of this study have moderate sense of self efficacy. The means and ranges for all three dimensions are indicated on figure 4.4

Concerning descriptives regarding gender difference**,** Table 4.3 reveals that girls *(M*=8.15*)* are more successful at CCT, have slightly more tentative beliefs (*M*=76.48), have higher meaningful learning orientations *(M* = 66.33*),* higher performance goal orientations *(M* = 14.13*)* and learning goal orientations *(M*=17.54*)* than boys. In contrast, girls *(M*=10.88*)* have slightly lower self efficacy than boys.

Table 4.3. Descriptives for achievement in CCT, learning orientations, epistemological beliefs and achievement motivation with respect to gender.

	Boys		**Girls**		**Total**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
CCT	7.75	2.79	8.15	2.46	7.9	2.64
EB	75.6	8.01	76.48	6.87	76.03	7.49
LA	62.74	7.79	66.33	7.63	64.51	7.92
PGO	13.77	3.34	14.13	3.45	13.95	3.4
LGO	16.76	2.89	17.54	2.62	17.14	2.79
SE	11.0	1.63	10.88	1.65	10.94	1.6

4.3. PART II: The Relationships among Variables of the Study

In the second part of this study, the research questions about the relationships between variables of the study are examined.

4.3.1. Research Question 5:

What are the possible relationships among 6th grade students' learning approaches, epistemological beliefs, achievement motivation and achievement in classification concepts?

Pearson correlation analysis was computed to explore the possible relationship between students' learning orientations, epistemological beliefs and achievement in classification concepts (Table 4.4).

Table 4.4 Correlation coefficient between variables

	CCT	PGO	LGO	SE	EB
CCT					
PGO	-.04				
LGO	.21**	.22**			
SE	-.02	.15**	.24**		
EB	.29**	.09**	. 57**	.13**	
LA	.34**	.004	.52**	.003	.5**

**Correlation is significant at the 0.05 level (2-tailed)

Analysis reveals that students' CCT scores were significantly correlated with their learning goal orientations *(r*=.21*, p*=.000*)* epistemological beliefs(*r*=.29, *p*=.000), and learning approaches *(r*=.34*, p*=.000*)*. The positive correlations showed that the higher the students' learning goal orientations, the greater the students' achievement and the greater the tentative beliefs they hold, the higher their achievement and similarly the more they use meaningful learning orientations the higher their achievement. However, the correlation of -.039 (*p*>.05) between performance goal orientations and achievement indicates that participants' performance goal orientations were not related to their achievement. Students who have high

performance goal orientations may or may not necessarily be successful on classification concepts test (or vice versa). Similarly, no statistically significant correlation between students' self efficacy and achievement on science was found ($p>$. 05). These data led to the conclusion that self efficacy was not related to achievement. Students who had more self efficacy may not necessarily have high achievement in classification concepts.

Learning Approaches, on the other hand, were significantly correlated with epistemological beliefs(r=.500, p=.000) and learning goal orientations *(*r=.52 p=.000*)*. The positive correlations showed that the more tentative beliefs and learning goal orientations students have, the more meaningfully they relate concepts with each other. Conversely learning approaches of students were not correlated with their self efficacy and performance goals. This means that students use of rote learning approaches or meaningful learning approaches does not related to their self efficacy ($p>$. 05) and performance goal orientations (r=.004, $p>$.05).

The present study revealed significant correlations between epistemological beliefs and students' performance goal orientations *(*r=.09 p=.007), learning goal orientations (r=57, p=.000) and self efficacy (r=.13, p=.000).The positive correlation between epistemological beliefs and the dimensions of achievement motivation show that, the higher the students' performance goal orientations, learning goal orientations and self efficacy, the more tentative beliefs they have.

Students' learning goal orientations were found to be significantly correlated with their performance goal orientations *(*r=.22, p=.000), indicating that, the higher the students' performance goal orientations, the higher their learning goal orientations.

In addition, students' learning goal orientations and performance goal orientations were significantly correlated with students' self efficacy (r=.24, p=.000; r=.15, p=.000 respectively). These mean that the higher students' believe that they are competent on a subject, the higher their learning goal orientations and performance goal orientations for achieving the task.

To be brief, these results suggest that students who hold tentative epistemological beliefs, learning goal orientations and meaningful learning orientations are more successful on classification concepts test.

4.3.2. Research Question 6:

What are the contributions of students' learning approaches, epistemological beliefs and achievement motivation on their achievement in classification concepts?

Multiple Regression Analysis is used to evaluate the contributions of each variable to achievement in classification of living things concepts. CCT scores are used as the dependent variable and there are six independent variables which are EB, SE, PGO, LGO and LA scores.

Multiple regressions have a number of assumptions which are sample size, multicollinearity, outliers, normality, linearity, homoscedasticity, and independence of residuals and before proceeding with the results, assumptions of Multiple Regression are checked.

For sample size, the formula by Tabachnick and Fidell (1996) was used in the calculation of sample size requirements. This requirement was calculated by using their formula which is $N > 50 + 8m$ (where m = number of independent variables) .In recent study, the number of independent variables was six and according to Tabachnick and Fidell (1996), the sample size should be larger than 98 for six independent variables. The sample size in the study was N=533 for boys, N=505 for girls and N=1041 for the total sample. Sample size in this analysis was larger than 98, so sample size of this analysis encountered this assumption.

The second assumption is multicollinearity. According to this assumption, correlations between independent variables should not be too high. As seen in table 4.4, none of the correlations exceed r=.7.

Table 4.4 Correlation coefficient between variables

**Correlation is significant at the 0.05 level (2-tailed)

	CCT	PGO	LGO	SE	EB	LA
CCT	1.00					
PGO	-.04	1.00				
LGO	.21**	.22**	1.00			
SE	-.02	.15**	.24**	1.00		
EB	.29**	.09**	. 57**	.13**	1.00	
LA	.34**	.004	.52**	.003	.5**	1.00

Moreover, collinearity diagnostic performed by SPSS resulted in Tolerance values that were all large enough to conclude that (.338 minimum) multiple correlations with other variables are not high, therefore all the variables are retained.

Other assumptions are outliers, normality, linearity, homoscedasticity and independence of residuals. Outliers were checked by inspecting Mahalanobis distances. Mahalanobis distances are distributed as a chi-square (c 2) variable, with degrees of freedom equal to the number of independent variables. The criterion for multivariate outliers is Mahalanobis distances at $p<.001$. In this study, there are six independent variables: In this case, critical c 2 at alpha=.001 for "6" *df* is 22.46 (Tabachnick & Fidell, 1996). For regression analysis, "5" cases exceeding the critical value of 22.46 was removed from the data as potential outliers. In addition, outliers for dependent variable were checked by inspecting a standardized residual and scatter plot. In this study, minimum standardized residual value was -3.1 and maximum standardized residual value was 3.6. The minimum value was between -3.3 and 3.3; however the maximum value was not. Thus, it appeared that there was one outlier on the dependent variable, which was classification concept test achievement score.

Then, linearity, homoscedasticity, and independence of residuals assumptions were checked by examining the standardized residuals and it was found that all the assumptions were met with no serious violations (see Figure 5.1 & Figure 5.2).
These assumptions may be controlled looking at residuals scatter plot and Normal Probability Plot (figures 4.5 and 4.6).

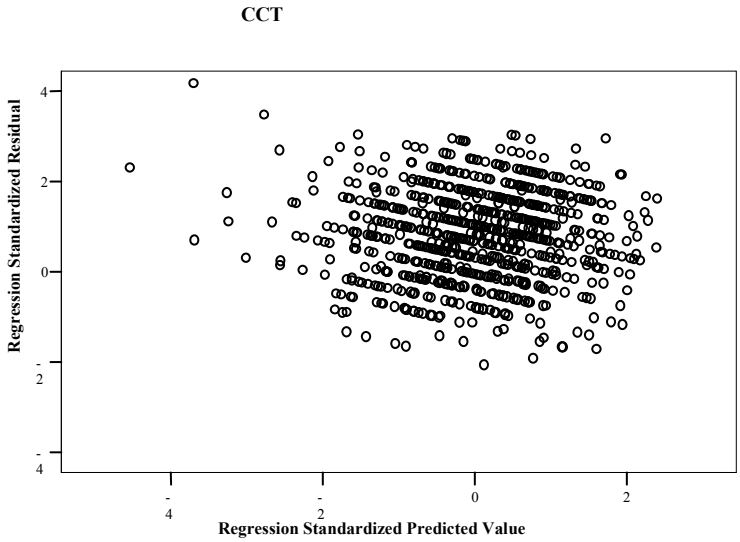

Figure 4.5. Scatter plot of the residual for achievement in Classification Concepts

Standardized Residuals Scatter plots seen in figure 4.5 showed roughly rectangular distribution without clear systematic patterns like curvilinear distribution. This shows that the homoscedasticity and independence of residuals assumptions are met. Again in the scatter plot, it can be seen that there were only few outliers. Investigation of mahalanabolis distances also revealed that there were few outliers, and the values were not too large, therefore these subjects were not removed from data. Pallant (2001) suggests that outliers are common in samples and it may not be necessary to take any action if only few are found.

Normal Probability plots were used to check the assumptions of normality and linearity. As seen in the figure 4.6, points were fairly in a straight diagonal line indicating linearity and no major deviations from normality.

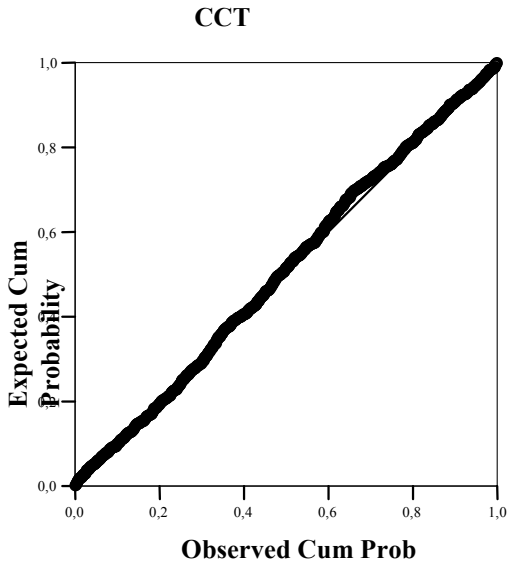

Figure 4.6. Normal probability plots for CCT

Having checked the assumptions, analysis of the contributions of the variables of the study to achievement in Classification of Living Things concepts was done using multiple regression analysis.

The multiple correlation (*R*) was .38, with R^2= .14. The results showed that the model significantly accounted for 14% of the variation in students' achievement of the classification of living things *(F*= 27.37*, p <* .05*)*. The largest beta coefficient was 0.27, which was for students' learning approaches indicating that this variable made the strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model is controlled for. Sign of the beta coefficient explained that the higher the scores students get from LAQ, the higher their achievement on classification concepts. The second significant variable predicting students' achievement on CCT was epistemological beliefs and the beta coefficient for this variable was .15 meaning that the more students believe in the tentativeness of knowledge, the higher their achievement on classification concepts These results can be seen on table 4.5.

Table 4.5. Independent contributions of PGO, LGO, SE, LA and EB to achievement of classification concepts.

Variables	Beta	*t*	*p*
PGO	-.05	-1.56	.58
LGO	.01	.21	.84
SE	-.05	-1.43	.15
LAQ	.27	6.73	.00
EB	.15	3.69	.00

4.3.3. Research Question 7:

Which variable best predicted 6th grade students' achievement in classification concepts?

A stepwise multiple regression analysis was performed to determine which variable best predicted 6th grade students' achievement in classification concepts.

TABLE 4.6. Stepwise multiple regression analyses for learning approaches and epistemological beliefs on achievement.

Model		Beta	*t*	*P*
1	**Learning Approaches**	.35	10.71	0.000
2	**Learning Approaches**	.28	7.41	0.000
	Epistemological Beliefs	.15	3.84	0.000

Results revealed that the main predictor of the students' achievement on CCT was their learning approaches , explaining 12% of the variance. In addition the second predictor in this study was epistemological beliefs of the students explaining the 2% of the variance.

4.4. Summary

Achievement scores showed that the subjects of this study have moderate achievement on classification of living things concepts. Results also revealed that girls have higher mean score than boys have.

Students in this study mostly believe in tentative nature of science. They thought that science is an evolving and contextual process and is constructed by the knower.

Students of this study mostly use meaningful learning approaches when studying science In other words; they usually form relationships between newly learned concepts and prior knowledge while studying.

Students have higher learning goal orientations than performance goal orientations which mean that they have the desire to learn something new and develop themselves instead of having a desire to get higher grades and perform better than other students.

Students in this study have moderate sense of self efficacy. They usually find themselves to be capable in being successful in a particular subject area or course.

Students' CCT scores were significantly and positively correlated with their learning goal orientations, epistemological beliefs and learning approaches. However, neither their performance goal orientations nor self efficacy beliefs were related to their achievement.

There was a significant positive correlation between students' learning approaches, epistemological beliefs and learning goal orientations.

There was a significant positive correlation among students' epistemological beliefs, performance goal orientations, learning goal orientations and self efficacy.

There was a significant positive correlation between students' self efficacy, learning goal orientations and performance goal orientations.

Students' learning goal orientations were significantly correlated with their performance goal orientations.

Lastly, self efficacy beliefs and performance goals of students were not correlated with their learning approaches.

MRC results showed that the variables of this study accounted for 14% of the variation in students' achievement in the classification concepts. About 12% of the variance was explained by learning approaches of the students. Remaining 2% of the variance was explained by epistemological beliefs of the students.

CHAPTER 5

DISCUSSION

5.1 Discussion

In the related literature, the importance of epistemological beliefs, achievement motivation, and learning approaches in science achievement have clearly been revealed. For example, Edmondson and Novak (1993) showed the importance of epistemological beliefs of students as these beliefs influence their learning, their choice of learning strategy and depth of their understanding. Cavallo and Schafer (1994), however, emphasized the importance of meaningful learning orientations in science education, as they allow students to form possible relationships among ideas, concepts and information and provide them to personalize concepts, link these concepts to their prior knowledge, and apply these newly learned concepts to solve problems. Another important variable considered in many recent studies was achievement motivations which were found to be significantly related to students' task choice, persistence, strategy use, and academic achievement (Ames, 1992; Anderman & Maehr, 1994).

In line with the previous findings, the present study investigated the predictive influences of epistemological beliefs, achievement motivation, learning approaches on sixth grade students' achievement in classification concepts. In the current study, Multiple Regression Correlation Analysis was used to examine contributions of students' learning approaches, achievement motivation and epistemological beliefs to their achievement in the classification concepts. Learning approaches and epistemological beliefs, but not achievement motivation made a statistically significant contribution to the achievement in classification concepts. A stepwise

multiple regression analysis was applied to the data in order to find out to what extend do learning approaches and epistemological beliefs can be used to predict achievement. Results revealed that the main predictor of the students' achievement on CCT was their learning approaches , explaining 12% of the variance. The second predictor of students' achievement on CCT was their epistemological beliefs explaining the 2% of the variance. Although these two variables of the study were found to be the predictors of achievement in classification concepts, achievement motivation couldn't predict achievement in classification concepts. These findings indicate that students with meaningful learning orientations and sophisticated epistemological beliefs have higher achievement in classification concepts compared to students with rote learning orientation and unsophisticated epistemological beliefs. In other words, students who formed relation between their previous and new knowledge, believed that science is an evolving and tentative process were high achievers in target concept. The results of the present study are consistent with the findings of previous research (Cavallo & Schafer, 1994; Cano, 2005). For instance, the results of Cano's (2005) study not only showed that epistemological beliefs and learning approaches are two predictors of academic achievement but also showed the interrelation of these two variables. According to this result, believing that learning occurred quickly and without effort brought surface approach, which in turn was linked negatively to performance. On the contrary, believing that learning occurs in a period and takes time brought deep approach, and was related negatively with naive epistemological beliefs. In another study, BouJaude (1992) reported that the students' performance on misunderstanding pre-test about chemistry concepts and their learning approaches both accounted for a statistically significant proportion of the variance on their performance on post-test.

The present study failed to show significant contribution of self-efficacy, learning goal orientation and performance goal orientation to students' achievement in classification concepts. Students who were confident in their ability to learn classification; had desire to achieve high grades, praise or to perform better than other students; intrinsically motivated and have desire for learning new things successfully were not necessarily more successful in this topic. This finding is not in

lined with the results obtained by Cavallo et al., (2004; 2003) who reported that self-efficacy predicted students' physics understanding and course achievement and motivation to learn for the sake of learning was important for course achievement for college biology students. Similarly in her study with 8th grade students, Atay (2006) however; showed that self efficacy didn't predict genetics achievement although there was a positive correlation between self efficacy and genetics achievement. Kang et al. (2005), however, revealed that self-efficacy was not statistically significantly related to the density conception test scores in computer assisted instruction. According to authors, the discrepancy between the findings may lie in the use of different kinds of instruction, the nature of concepts instructed, and in the context specific nature of self-efficacy (Pintrich et al., 1993). Another reason for these different results about the self efficacy may be the younger participants of the current study who are attending to 6th grade. The responses of these students to self-report instruments may not be so realistic in their ability judgments; therefore students' responses to self-efficacy scale may not be a trustworthy measure of their self-efficacy (Pintrich & Schunk, 2002).

In an earlier study, Cavallo and Schafer (1994) showed that meaningful learning orientation contributed to students' attainment of meaningful understanding independent of aptitude and achievement motivation. The findings revealed that a meaningful learning approach among students may be important, perhaps as much or more than aptitude and achievement motivation, for meaningful understandings of science.

In the present study, Pearson correlation analysis revealed significant associations of subjects' achievement in classification with their epistemological beliefs, learning approaches and learning goal orientations .The positive correlation between tentative epistemological beliefs and achievement was in line with the findings of the related literature (Schommer, 1990, 1993; Schommer & Hutter, 2000). The related studies showed the relationship between beliefs about knowledge and GPA and indicated that students' having the idea that knowledge is a set of isolated facts and that knowledge is certain have lower overall GPA's. Accordingly in current study, the

higher the students hold tentative beliefs, the higher the scores they get from CCT. Finding positive and significant correlation between students' learning approaches and achievement on CCT meant that students who approach learning in order to learn meaningfully tend to perform well compared to those who adopted rote approaches. This means that students who were attempting to learn science by forming relationships among concepts had greater achievement in the target concept. In fact, the learning of classification concepts requires the ability to connect ideas from other fields of science. In addition, the existence of a significant association between learning approaches, epistemological beliefs and learning goal orientations of the participants were revealed. The findings of the present study were consistent with the results in the literature (Cavallo, 1996; Cano, 2005). Cavallo, (1996) reported that students' meaningful learning orientations were correlated with their achievement on TGM and TGP tests which determine students understanding, knowledge and ability to use Punnet square diagrams. Moreover, Cano (2005) showed epistemological beliefs' and learning approaches' effect on academic achievement and their significant interrelation by studying with secondary students. First, he showed the direct and significant effect of epistemological beliefs on academic achievement. He explained that students who believe that learning occurs gradually and is not a fixed ability, and that knowledge is an organized structure and is not absolute or unambiguous achieve most academic success. Secondly, he explained the indirect effect of epistemological beliefs on achievement. He indicated the influence of students' learning approaches on their epistemological beliefs which finally affects their academic performance.

In their study Paulsen and Feldman (1999) found significant relationship between the epistemological beliefs of students and their motivation while learning particular course of study. Comparing the students with the sophisticated belief that the structure of knowledge is complex to students with the naive belief that the structure of knowledge is simple, students with naïve belief found to be less likely to have an intrinsic goal orientation, to appreciate the value of learning tasks, to perceive an internal control over learning, and to feel efficacious about their capacity to learn. Students with the naive belief in simple knowledge were also found to have extrinsic

goal orientation and higher levels of test anxiety more than students with more sophisticated beliefs. This study reached the same result with Paulsen and Feldman's study, however there was a difference that in current study, epistemological beliefs of students were not examined according to the dimensions. In addition, in current study, three dimensions of achievement motivation were examined. The results of current study showed that goal orientations of students are positively correlated with each other. Accordingly, students who were aware of the complexity of knowledge and believed that learning requires time and effort tended to accept the more adaptive mastery (task or learning) goal orientations. In contrast, students who viewed knowledge as isolated and believed that learning is a process that occurs quickly tend to adopt performance (ego or ability) goal orientations. Finding positive and significant relation among students' epistemological beliefs, performance goal orientations, learning goal orientations and self efficacy were in line with the findings of Paulsen and Feldman (2005). They reported that students who believe that the structure of knowledge is complex; rather than believe that the structure of knowledge is simple were less likely to have an intrinsic goal orientation, to find learning tasks noteworthy, to direct their learning and to believe in their learning capacity. Students with the naïve belief in simple knowledge were also more likely to have an extrinsic goal orientation and to experience higher levels of test anxiety than their peers having more sophisticated beliefs. In contrast, students having naïve belief and accept quick learning were less likely to have an intrinsic goal orientation, to value the learning tasks, to have an internal control over learning than students with the more sophisticated beliefs and accept gradual learning. Students who believe that the ability to learn is fixed were less likely to have intrinsic goal orientation, to appreciate learning, to perceive an internal control over learning and to feel efficacious about their capacity to learn than their peers with more sophisticated belief and believe in the improvement of ability to learn. Regarding the findings of related literature, the results of present study made some conclusions. According to the positive correlation between epistemological beliefs and the dimensions of achievement motivation, the higher the students' performance goal orientations, learning goal orientations and self efficacy, the more tentative beliefs they have and therefore, the more they believe that knowledge is complex rather than

simple, knowledge is tentative rather than certain, the ability to learn is acquired rather than innate and learning needs time.

The results of the present study revealed positive and significant association between students' epistemological beliefs, goal orientations and learning approaches. Accordingly, subjects with tentative beliefs and learning goal orientations were able to relate concepts with each other meaningfully more than their peers with fixed beliefs and performance goal orientations. In the related literature there are consistent findings with the results of current study. In his study, Chan (2003) reported the relation between surface approach and belief that ability to learn is fixed, knowledge is handed down by authority and that knowledge is unchanging. In addition, he found that students who believed that knowledge is certain, unchanged, and handed down by authority were likely to use surface approach instead of a deep approach. Considering these findings, it is obvious that the results of the current study was same with Chan's results and revealed the same correlation with epistemological beliefs and learning approaches of students.

Examining the relationship between self efficacy, performance goal orientations and learning goal orientations, in present study, students' self efficacy was found to be significantly correlated with students' learning goal orientations and performance goal orientations . These findings implied that, as students' level of self efficacy and belief that they are competent on a subject increase, their learning goal orientations and performance goal orientations also increase for achieving the task. Pajares (2003) found same results with findings of present study by examining the research findings in literature that deal with the relationship between writing self-efficacy, other motivation constructs related to writing, and writing outcomes in academic settings. Pajares reported that students' confidence in their writing capabilities influence their writing motivation and judgments of personal efficacy affect what students do by influencing the choices they make, the effort they expend, the persistence and perseverance they exert when obstacles arise, and the thought patterns and emotional reactions they experience. He gave a clear example which notifies that a strong sense of confidence brings greater interest and attention to

writing, stronger effort, and greater perseverance and resiliency despite the obstacles. Moreover, confident students are likely to feel less anxious and they respect their writing.

The results of current study revealed a positive and significant relationship between learning goal orientations and performance goal orientations of students .This result implies that students with higher learning goal orientations also have higher performance goal orientations. This finding of current study in favor of performance goal orientations is not in line with the early findings about achievement goals in the literature which emphasized the drawbacks of performance goals (Ames, 1992; Dweck, 1986, 1999; Dweck & Leggett, 1988). Those findings showed that students motivated towards performance goals do not concentrate on learning something new for the sake of learning instead they concentrate on achieving high grades or praise or to perform better than other students. Conversely in recent years, some researchers have concluded that performance-approach goals promote high achievement and do not affect motivation and engagement negatively (e.g., Barron & Harackiewicz, 2000, 2001). Considering learning goal orientations, literature revealed that people who have these goals are intrinsically motivated and have desire for learning new things and these goals promote high achievement. Comparing the results of current study with these recent findings, the results of this study revealed no relationship between students' performance goal orientations and achievement on science test ($r=-.039$; $p>.05$) meaning that students who have high performance goal orientations may or may not necessarily be successful on science test (or vice versa).

In conclusion, this study has shown the importance of students' learning approaches and epistemological beliefs in their achievement in classification concepts. In other words, students who construct their knowledge by relating their previous and new knowledge, create new ideas, believe in the tentative nature of knowledge had higher achievement in classification concepts. On the other hand, students who memorize the facts without relating them with their previous knowledge believe that the knowledge is certain and unchanging were less likely to achieve in these concepts.

5.2 Internal Validity of the Study

According to Fraenkel and Wallen, (1996) internal validity of the study refers to the degree to which the observed differences on dependent variables are directly related to independent variables, not to extraneous variables that may affect the results of the research. In this part, possible threats to internal validity and the methods used to cope with them were discussed.

In this correlational research, surveys used and mortality, location, instrumentation, and instrument decay were the possible threats to internal validity of this study.

Mortality could not be a threat to this study since this threat was prevented by direct implementation of surveys by the researcher in 11 schools in Çankaya district of Ankara and 1041 students answered the surveys and gave the surveys back to the researcher as they finish them.

Examining the location, it was seen that the application conditions of surveys were similar for all the subjects of this study, therefore location could not be a threat to this study.

Instrumentation, such as instrument decay and data collector characteristics couldn't be threats to this study. The instruments were long but in order to control instrument decay, participants were motivated to complete during the administration of the questionnaires. For instance, the importance of that research, and the importance of their valuable support were told by the researcher. In addition, nearly all questionnaires were applied to the participants by the researcher.

5.3 External Validity of the Study

There are two types of external validity: population generalizability and ecological generalizability which are the degree of results of the study to be generalized. Population generalizability is the level to which a sample represents the population

of interest, and ecological generalizability refers to the level to which the results of a study can be generalized to other settings or conditions (Fraenkel & Wallen, 1996).

Subjects of this study were from the 11 randomly selected public schools from Çankaya and the sample size was 10% of this population, this population would be large enough for generalizing the findings of the study, however, some limitations of this study prevents this generalizability: The investigation was conducted this public schools located in a large urban area without involving the subjects from other school districts and from other school types such as private schools. Therefore, being careful in generalizing the results from this study is very important.

Considering the environmental conditions, it was believed that external effects were controlled by the settings used in the study satisfactorily since the administration process took place in ordinary classrooms during standard class hours, and environmental conditions were nearly the same.

5.4 Implications of the Study

The importance of epistemological beliefs and choices of learning approaches are revealed by the results of this study as they determine sixth grade students' achievement in classification concepts. Accordingly, this study has some educational implications:

1) Science teachers should encourage students to develop both sophisticated epistemological beliefs and meaningful learning approach.

2) Students' beliefs about knowing and learning and their meaningful learning orientations should be enhanced in order to encourage them to choose making sense of scientific explanations of phenomena rather than memorizing the facts and terminology.

3) Learning should be viewed as a constructive process in which an active learner builds his/her own knowledge.

5.5 Recommendations for Further Research

There are some suggestions of present study for further studies:

1) This study was limited with data gained from self-reports therefore multiple methods would be used in further study for confirming the consistency and accuracy of the findings of present study. Qualitative research would be included to the further study.

2) The data was provided from one district of Ankara; therefore, further study may include investigations in different districts.

3) The subjects of the study were from the public schools which are very similar; therefore further study can consider different school types such as private elementary schools.

4) The research findings were limited to classification of living things concept; therefore further study can include other science topics.

5) This study examined epistemological beliefs without considering each of the dimensions; therefore further study may investigate all these four dimensions which are source, certainty, development and justification.

6) Reliability of Classification Concept Test (CCT) was calculated as r=.60 which is relatively low. The reliability of this test may be increased by increasing the number of items it involves and by further revision of the test.

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APPENDICES

APPENDIX A
ACHIEVEMENT MOTIVATION QUESTIONNAIRE

Sevgili Öğrenci,

Bu anketler sizin Fen Bilgisi derslerine karşı yaklaşımınızı ölçmek amacı ile hazırlanmıştır. Tüm sorular, **FEN BİLGİSİ SINIFINDAKİ** öğrenme süreciniz ve çalışma alışkanlıklarınız ile ilgilidir. Her soru için "Kesinlikle **Katılmıyorum**" ve Kesinlikle **Katılıyorum**" arasında değişen dört derecelendirme vardır. Sorulara cevap verirken uzun uzun düşünmeyin, genellikle vereceğiniz ilk tepki doğrudur. Bu sorulara vereceğiniz yanıtlar, araştırma amacıyla kullanılacak, ve gizli tutulacaktır.Görüşleriniz bizler için çok önemlidir. Lütfen tüm soruları yanıtlayın. Boş bırakmayın.

Yardımlarınız için teşekkür ederim

Kişisel Bilgiler

1. Cinsiyetiniz: Kız Erkek
2. Doğum tarihiniz (yıl): _____
3. Geçen yılki Fen Bilgisi karne notunuz: _____

	KESİNLİKLE **KATILMIYORUM**	**KATILMIYORUM**	KATILIYORUM	KESİNLİKLE KATILIYORUM
1 . Fen dersindeki ana hedeflerimden birisi yaptığımız bilimsel aktiviteleri anlamaktır.				
2 . Fen dersinde öğrendiğimiz konularla ilgili fen bilgisi problemlerini çözeceğim konusunda kendime güveniyorum.				
3 . Fen dersindeki ana hedeflerimden birisi diğer öğrencilerden daha başarılı olmaktır.				
4 . Fen dersinde gördüğümüz problemlere benzer problemleri çözebileceğime inanıyorum.				
5 . Fen dersindeki ana hedeflerimden birisi, yeni bir şeyler **öğrenmesem** bile iyi bir not almaktır.				
6 . Fen dersinde ana hedeflerimden birisi sınıftaki aktivitelerde beceriksizce **görünmemektir**.				
7 . Fen dersindeki ana hedeflerimden birisi diğer öğrencilerden daha zeki görünmektir.				
8 . Fen dersindeki ana hedeflerimden birisi çalıştığımız konuları anlamaktır.				
9 . Fen dersinde tek başıma deney yaparken sorun yaşayacağımı düşünürüm.				
10 . Fen dersindeki ana hedeflerimden birisi bilgimi artırmaya çalışmaktır.				
11 . Fen dersindeki ana hedeflerimden birisi bu derste başarısız olan tek kişi **olmamaktır**.				
12 . Fen dersindeki ana hedeflerimden birisi yaptığımız fen aktiviteleri sırasında neler olup bittiğini anlamaktır.				
13 .Sınıfta yaptığımız fen aktivitelerinde, diğer öğrenciler kadar iyi **değilim.**				
14 . Fen dersindeki ana hedeflerimden birisi, aldığım not her ne olursa olsun yeni bir şeyler öğrenmektir.				

APPENDIX B
EPISTEMOLOGICAL BELIEFS QUESTIONNAIRE

	KESİNLİKLE **KATILMIYORUM**	**KATILMIYORUM**	KATILIYORUM	KESİNLİKLE KATILIYORUM
1 . Tüm insanlar, bilim insanlarının söylediklerine inanmak zorundadır.				
2 . Bilimde bütün soruların tek bir doğru yanıtı vardır.				
3 . Bilimsel deneylerdeki fikirler, olayların nasıl meydana geldiğini merak edip düşünerek ortaya çıkar.				
4 . Günümüzde bazı bilimsel düşünceler, bilim insanlarının daha önce düşündüklerinden farklıdır.				
5 . Bir deneye başlamadan önce, deneyle ilgili bir fikrinizin olmasında yarar vardır.				
6 . Bilimsel kitaplarda yazanlara inanmak zorundasınız.				
7 . Bilimsel çalışma yapmanın en önemli kısmı, doğru yanıta ulaşmaktır.				
8 . Bilimsel kitaplardaki bilgiler bazen değişir.				
9 . Bilimsel çalışmalarda bilim insanının düşüncelerini test edebilmesi için birden fazla yol olabilir.				
10 . Fen bilgisi dersinde, öğretmenin her söylediği şey doğrudur.				
11 . Bilimdeki düşünceler, konu ile ilgili kendi kendinize sorduğunuz sorular ve deneysel çalışmalarınızdan ortaya çıkabilir.				
12 . Bilim insanları bilim hakkında hemen hemen her şeyi bilir, yani bilinecek daha fazla bir şey **kalmamıştır.**				
13 . Bilim insanlarının bile **yanıtlayamayacağı** bazı sorular vardır.				
14 . Olayların nasıl meydana geldiği hakkında yeni fikirler bulmak için deneyler yapmak, bilimsel çalışmanın önemli bir parçasıdır.				

	KESİNLİKLE **KATILMIYORUM**	**KATILMIYORUM**	KATILIYORUM	KESİNLİKLE KATILIYORUM
15 . Bilimsel kitaplarda bir şey okuduğunuzda, okuduklarınızın doğru olduğundan emin olabilirsiniz.				
16 . Bilimsel bilgi her zaman doğrudur.				
17 . Bilimsel düşünceler bazen değişir.				
18 . Sonuçlarınızdan emin olmak için, deneylerin birden fazla tekrarlanmasında fayda vardır.				
19 . Sadece bilim insanları, bilimde neyin doğru olduğunu kesin olarak bilirler.				
20 . Bilim insanının bir deneyden aldığı sonuç, o deneyin tek yanıtıdır.				
21. Yeni buluşlar, bilim insanlarının doğru olarak düşündüğü şeyleri değiştirir.				
22 . Bilimdeki parlak fikirler sadece bilim insanlarından değil herhangi birinden de gelebilir.				
23 . Bilim insanları bilimde neyin doğru olduğu konusunda her zaman hemfikirdirler.				
24 . İyi çıkarımlar, bir çok farklı deneyin sonucundan elde edilen kanıtlara dayanır.				
25 . Bilim insanları bilimde neyin doğru olduğu ile ilgili düşüncelerini bazen değiştirirler.				
26. Bir şeyin doğru olup olmadığını anlamak için deney yapmak iyi bir yoldur.				

APPENDIX C
LEARNING APPROACHES QUESTIONNAIRE

	KESİNLİKLE **KATILMIYORUM**	**KATILMIYORUM**	KATILIYORUM	KESİNLİKLE KATILIYORUM
1. Genellikle ilk bakışta zor gibi görünen konuları anlamak için çok çaba sarf ederim.				
2. Bir konuya çalışırken, öğrendiğim yeni bilgileri o konuyla ilgili eski bilgilerimle ilişkilendirmeye çalışırım.				
3. Ders çalışırken, öğrendiğim konuları günlük hayatta nasıl kullanabileceğimi düşünürüm.				
4. Konuları en iyi, öğretmenin anlattığı sırayı takip ettiğimde hatırlarım.				
5. Öğrenmek zorunda olduğum konuları ezberlerim.				
6. Önemli konuları tam olarak anlayana kadar tekrar ederim.				
7. Öğretmenler, öğrencilerin sınavda **çıkmayacak** konulara çok fazla zaman harcamalarını **beklememelidirler**.				
8. Bir kez çalışmaya başladığımda, her konunun ilgi çekici olacağına inanırım.				
9. Derslerde edindiğim veya kitaplardan okuduğum bilgiler hakkında sık sık kendime sorular sorarım.				
10. Konuları birbirleri ile ilişkilendirmenin yeni bir konu hakkında genel bir fikir vermesi bakımından faydalı olduğunu düşünürüm.				
11. Anladığımdan iyice emin olana kadar ders ya da laboratuvar notlarımı tekrar tekrar okurum.				
12. Bir konu hakkında çok fazla araştırma yapmanın zaman kaybı olduğunu düşünürüm. Bu nedenle sadece sınıfta ya da ders notlarında anlatılanları ciddi bir şekilde çalışırım.				
13. Okumam için verilen kaynakları (kitap gibi), anlamını tam olarak anlayıncaya kadar okurum.				
14. Gerçek olaylara dayanan konuları, varsayıma dayanan konulardan daha çok severim.				
15. Bir konuda öğrendiğim bilgiyi başka bir konuda öğrendiğimle ilişkilendirmeye çalışırım.				
16. Benim için teknik terimlerin ne anlama geldiğini anlamanın en iyi yolu ders kitabındaki tanımları hatırlamaktır.				
17. Bulmaca ve problemler çözerek mantıksal sonuçlara ulaşmak beni heyecanlandırır.				
18. Genelde okumam için verilen materyalin bana sağlayacağı faydayı **düşünmem**.				
19. Konuları ezberleyerek öğrenirim.				
20. Çoğunlukla, konuları gerçekten anlamadan okurum.				
21. Fazladan okumalar kafa karıştırıcı olduğu için, derslerde önerilen okumaların sadece bir kısmına bakarım.				
22. Fazladan bir şeyler yapmanın gereksiz olduğunu düşündüğüm için, çalışmamı genellikle derste verilen bilgiyle sınırlarım.				

APPENDIX D
CLASSIFICATION CONCEPT TEST

1) Çiçekli bitkilerin en önemli özelliği aşağıdakilerden hangisidir?

a) Nemli yerlerde yaşamaları

b) Süs bitkisi olarak kullanılabilmeleri

c) Kokulu ve çeşitli olmaları

d) Tohum oluşturmaları

2) Aşağıdakilerden hangisi çiçeğin bölümlerinden biri değildir?

a) Çanak yaprak **b)** Taç Yaprak **c)** Kök **d)** Dişi organ

3) Aşağıdakilerden hangisi besin zincirine örnektir?

a) Ot	Çekirge	Kurbağa
b) Yılan	Fare	Buğday
c) Ot	Yılan	Kurbağa
d) Aslan	Geyik	Ot

4) Aşağıdakilerden hangisi kökün görevi değildir?
a) Bitkiyi toprağa bağlar
b) Topraktaki madensel tuzları emer
c) Bitkiyi dik tutar
d) Topraktaki suyu alır

5) Besin üretimi, gaz alışverişi gibi faaliyetler bitkinin hangi kısmında gerçekleşir?

a) Çiçek **b)** Gövde **c)** Kök **d)** Yaprak

6) Aşağıdakilerden hangisi hem otla hem de etle beslenir?

a) Ayı **b)** Aslan **c)** İnek **d)** Tavşan

7) Aşağıdakilerden hangisi su yosunu ile eğrelti otunun ortak özelliğidir?

a) Çiçekli olma **b)** Besin yapma **c)** Suda yaşama **d)** Bölünerek çoğalma

8) Aşağıdaki canlılardan hangisi omurgalıdır?

a) Salyangoz **b)**Arı **c)** Deniz Yıldızı **d)** Yılan

9) Aşağıdakilerden hangisi çiçeksiz bir bitkidir?

a) Mantar **b)** Kara Yosunu **c)** Papatya **d)** Erik

10) Aşağıdakilerden hangisi besinini kendisi yapamaz?

a) Çam Ağacı **b)** Su yosunu **c)** Mantar **d)** Menekşe

11) Aşağıdaki canlılardan hangisi yaşama alanıyla doğru olarak eşleştirilmemiştir?

a) Yunus- Su **b)** Yarasa- Kara
c) Kaktüs Dere Kenarı **d)** Solucan Toprak altı

12) Aşağıdakilerden hangisi memelilerin ortak özelliği değildir?

a) Yavrularını kendi sütleriyle beslerler
b) Yumurta ile çoğalırlar
c) Vücutları tüylerle örtülüdür
d) Omurgalılar grubunda yer alırlar

13) Bitkide besin ve su iletimini sağlayan kısım aşağıdakilerden hangisidir?

a) Kök **b)** Gövde **c)** Çiçek **d)** Yaprak

14) Aşağıdakilerden hangisi bitkilerin besinidir?

a) Karbondioksit **b)** Su ve mineraller **c)** Toprak **d)** Şeker

15) Diğerlerine göre farklı grupta yer alan canlı aşağıdakilerden hangisidir?

a) Yarasa **b)** Sinek **c)** Çekirge **d)** Karınca