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Curricular Elements of Problem-Based Learning That Cause Developments of Self-Directed Learning Behaviors Among Students and Its Implications on Elementary Education

Ulku Serezli Karabulut

University of Tennessee - Knoxville

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To the Graduate Council:

I am submitting herewith a thesis written by Ulku Serezli Karabulut entitled "Curricular Elements of Problem-Based Learning That Cause Developments of Self-Directed Learning Behaviors Among Students and Its Implications on Elementary Education." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Education.

<div align="right">Thomas N. Turner, Major Professor</div>

We have read this thesis and recommend its acceptance:

Lester N. Knight, Colleen P. Gilrane

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<div align="right">Vice Provost and Dean of the Graduate School</div>

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Lester N. Knight

Colleen P. Gilrane

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Accepted for the Council

  Anne Mayhew

Vice Provost and

Dean of Graduate Studies

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Curricular Elements of Problem-Based Learning That Cause Developments of Self-Directed Learning Behaviors Among Students and Its Implications on Elementary Education

A thesis presented for the Master of Science Degree

The University of Tennessee, Knoxville

Ulku Serezli KARABULUT

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ABSTRACT

Rapid technological and social changes and developments in the world put high demands on individuals. The high demanding world increases the pressure on educational systems to be more effective. "Therefore, educators have looked at constructivist pedagogical designs that are based of cognitive and social interactions in problem-centered environments" (Greeno, Collins, & Resnick, 1996; Savery & Duffy, 1994). It is claimed that the active learning emphasized in PBL promotes self-directed learning strategies needed for lifelong learning. Self-directed learning is related with cognitive ability, self-concept, and achievement. Therefore, it is important to determine curricular elements of problem-based learning that cause self-directed behaviors among its students. Problem-based curriculum is student centered, students attempt to identify and solve a problem with their existing knowledge, they identify knowledge deficits and generate appropriate learning issues, they independently search the learning issues, critiquing the resources used for research, and apply the new knowledge to the problem, and students in the small group collaborative reflection on self-directed behavior improve students' self-directed behaviors. It is believed that discussions in the tutorial group, content to be tested, lectures, tutor, and reference literature also impact

on students' self-directed behaviors.

Most of the studies about problem-based learning and self-directed behaviors have been carried out among college students more particularly among medical students. On the other hand elementary students have different characteristics than do medical students. The basic elements of problem-based curriculum, which affect students' self-directed learning behaviors, require some changes and modifications so that they can be effectively applied to elementary-aged students.

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CHAPTER I

INTRODUCTION

Background of The Present Study

Rapid technological and social changes and developments in the world put high demands on individuals. Individuals need to have an increasing amount of knowledge, be better problem solvers in all aspects of life, be good collaborators in their working environment, be able to apply that knowledge in novel situations, and be able to keep that knowledge updated. Despite the fact that world changes rapidly, education systems have not been changed at the same pace with the world. The result is that the high demanding world increases the pressure on educational systems to be more effective. Educational systems have received many criticisms. One major reason is that schools teach students to be passive knowledge seekers. Students are given knowledge that is neither irrelevant nor integrated with their previous knowledge. Students graduate from schools without developing continuing educational skills.

Though students gain knowledge through education, they do not know what this knowledge is for or how to use it. They also lack skills that are needed to help them decide where and how to find resources and how to use these resources. As a result students are not able to learn by themselves and always wait someone to assist them. They learn superficially, lack motivation and most importantly are unable to adapt themselves to rapid changes of society in terms of both knowledge

and technology. As Romey (1975) states " teachers have responsibility of the educational process; they decide goals, present the topic to be learned, evaluate students, select problems to be learned. Therefore, students do not feel responsible for their own educational future" despite the fact that learning is an active and individual phenomenon. Knowles (1975) further posits that rapid change seems to be the only stable characteristic of the world. Doubling of available knowledge in every six months leads to change in schools goals as well. Therefore transmission of knowledge, which is traditionally an important goal of education, may no longer be achieved. Individuals in this highly demanding world need to have some skills, which help them to continue their learning throughout their lives. They must be able to obtain further knowledge and skills throughout their lives. This ability is called self-directed learning.

Schools have to give answers two important questions in any educational system. The first question is, what is to be learned? The answer to this quest indicates decisions about curriculum. The second question is, how students will learn? This question refers to instruction (White, 1982). Schools cannot provide necessary and sufficient knowledge base to individuals in the rapidly developing world. Therefore, the roles of the educational organizations need to be changed. They are not only responsible students' necessary knowledge base, but also to fortify students with some specific skills including problem solving, self-directed learning, and reasoning skills. Improving students' self-directed learning strategies seems much more effective way of helping students to adapt the changing and demanding world than just providing them an old-fashioned knowledge base.

For this reason educators are now looking for new applications, which will provide that needs of changing world. "Therefore, educators have looked at constructivist pedagogical designs that are based of cognitive and social interactions in problem-centered environments" (Greeno, Collins, & Resnick, 1996; Savery & Duffy, 1994). "It is an approach to learning and instruction in which students tackle problems in small groups under the supervision of tutors" (Schmidt, 1993). Cognitive research suggests that learning is an active process. Problem-based learning (PBL) involves creating an environment in which individuals actively engage in learning process, take responsibility for their own learning, and become better learners in terms of time management skills, ability to define learning topics, ability to find resources and ability to evaluate validity of these sources.

Problem-based learning, which was first developed at medical schools, has five objectives: to increase students' knowledge base, to develop clinical problem solving strategies, to develop self-directed learning skills, to increase motivation to learn and help them to be a better collaborators. It is claimed that, as a new instructional method, problem-based learning develops self-directed learning skills of individuals as one of the important objectives of problem-based curricula. In PBL, students "learn to learn" so that they can make their learning relevant to their own educational needs (Barrows & Tamblyn, 1980). Students analyze and discuss problems in a way that they can see the gaps in their own knowledge base and realize their own strength and weak points control their own learning and develop self-regulatory skills (Glaser, 1991).

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On top of all that, in problem-based learning students learn how to reach and evaluate knowledge and materials. They also keep and use that skill after their graduation (Barrows & Tamblyn). Evensen and Hmelo (2000) cite it; Bereiter & Scardamalia claimed that the active learning emphasized in PBL promotes self-directed learning strategies needed for lifelong learning. According to Barrows there are two elements in problem-based learning that effect the degree of achievement of its objectives. These are the problem itself and the locus of control. However, it is not clear if these two elements of a problem-based learning curriculum alone lead to the development of self-directed learning skills of students. The question is, what are the other elements of problem-based learning help individuals to develop self-directed learning skills?

It is the learner who does constructive activities in learning to acquire necessary knowledge. It has been found that educational strategies in which learning is seen as a passive process of transmitting information into memory are usually characterized by a high level of external regulation by instruction, encourage students merely to memorize information. On the other hand, educational strategies in which learning is seen as an active constructive process are, usually characterized by a high level of internal regulation by students and encourage students to relate and structure information (Vermunt, 1989). Mayer and Greeno (1972) further show how different instructional methods result in different educational outcomes. "As a result, when learning is necessary and desired, the individual will need to determine what is to be learned, how best to learn it and how well it is to be learned. This indicates the need of learning as self-directed" (Houle, 1980; Cavanaugh, 1993). These criticisms do match with those of USMES Guide (Unified Sciences and Mathematics for Elementary School)

comment that: " To learn the process of real problem solving, the students must encounter, formulate and find some solutions to complete and realistic problems. The students themselves, not the teacher, must analyze the problem, choose the variable that should be investigated, search out the facts, and judge the correctness of their hypotheses and conclusions. The teacher acts as a coordinator and collaborator, not an authoritative answer giver." This statement clearly indicates the importance of educational environment that supports the development of self-directed learning skills of students. The term self-directed learning has been used mostly in adult and continuing education and basically in health profession. Although many research studies were conducted about self-directed learning in the health profession few studies have been carried out in elementary schools.

In order to develop self-directed learning skills, students need to be given responsibility for their learning. Lane P.S. (1992) mentioned about Kruglanski (1978). Kruglanski believed that this opportunity of engagement of their learning causes higher quality of engagement and output, as well as increased motivation to learn and increased effort expanded on learning (Corno & Rohrkemper, 1985).

Self-directed learners and their teachers together share the responsibility of the classroom activities. However, sharing responsibility in the classroom does not mean that there is no teacher control nor does it mean that all the decisions about learning process are given by students. On the contrary, the role of the teacher becomes more complex and demanding. A teacher needs to determine how students learn, learning strategies they apply, strength and weak points of them in the learning process. Therefore, teachers must be careful observers,

facilitators and supporters. Teachers need to help students to become self-directed learners in ways that they become more responsible for their own learning. By giving students responsibility of their own learning they learn how to learn and as a result their learning is improved. Thus, students must be helped on their way to becoming self-directed learners in the education process. It is proposed that once students become self-directed learners, they not only take responsibility of themselves, but also become responsible individual in the society. In Teaching for Self-Directed Living and Learning in Students (Bradley, 1991) says:

" As long as judgment making regarding a student's educational program remains a function of the teacher, it will do little to help him (the student) become more of a self-directing person. The modern teacher gives a student a share in deciding what is best for him, and through this participation, there is greater assurance that each student will be more self-directing serving the purpose of democratic society. Democracy is so hard to get, but so easy to lose. It implies more restraint than any other form of government. The most important outcome of formal education in a democracy is the ability to be self-directing (p.103).

Teachers are not the only factor in the process of learning and development of self-directed strategies of students. There are other elements in the learning process that affect quality of learning and development of self-directed strategies among students. The other curricular elements of problem-based learning might direct the development of self-directed learning strategies have yet to be identified. Most of the studies related to PBL and SDL has been done mostly among college students, basically medical students. This begs three questions:

1- Can elementary students are taught self-directed learning strategies?

2- Are findings of problem-based learning and self-directed learning of undergraduate students applicable to elementary students?

3- What can be done for elementary students to develop self-directed learning strategies?

Statement of the Problem

The intent of this study is to define and investigate the nature of problem-based learning environment through a careful examination of the literature, define self-directed learning and specify the relationship between elements of PBL on development of self-directed learning skills.

RESEARCH QUESTIONS:

The study attempts to answer the following:

1- What is PBL?

2- What are the elements of PBL that direct development of self-directed learning skills among students?

3- What other curricular elements of PBL might affect the development of self-directed learning behavior?

4- What is SDL?

5- What are the behavioral characteristics of self-directed students?

6- What are the other factors if any in problem-based learning that affects the development of SDL skills?

7- Does PBL cause lifelong learning on individuals?

8- Besides its effect on SDL on medical undergraduate students, is it possible to apply PBL to develop SDL skills for elementary or middle grade students?

Purpose of the Study

Pursuant to these questions the purpose of this study is to determine which claimed that the active learning emphasized in PBL promotes self-directed learning strategies needed for lifelong learning.

This study is important because research about problem-based learning has been basically done for higher education levels, and, more particularly among medical students, who are naturally able to respond to the high demands of medical education and inherently motivated. On the other hand elementary students have different characteristics than do medical students, and no extensive research has been done to describe PLB applications in elementary education.

Definition of Terms

Problem-based Learning: An instructional method that uses problems as a starting point in understanding and explaining a phenomenon in learning process.

Self-directed Learning: Students' ability to take controls their learning that helps them at acquiring information or skill.

Self-Regulated Learning: Learning that is the result of conscious behaviors of students directed toward achieving learning objectives.

Meta-cognition: Knowing goal of learning, self-assessing how well they are doing with respect to that goal (Barron et al., 1998).

Methodology of The Study

This research is attempting to answer the basic research questions through a review of existing literature. This is the study of studies about effects of curricular elements of problem-based learning on students' self-directed behaviors. I found it necessary to draw applications about factors that lead to self-directed behaviors. The basic elements of problem-based curriculum, which affect students' self-directed learning behaviors, have already been stated in the adult literature. Such applications require some changes and modifications so that they can be effectively applied to elementary-aged students.

Limitations of The Study and Suggestions for Future Research

Self-directed learning is an important topic in adult education and mostly studied among undergraduate medical students. Even though there is a controversy, it is believed that elementary students are not developmentally mature enough to exhibit and learn self-directed behaviors. The self-directed literature is specific to undergraduate and basically medical education. Therefore, when you think about developmental level, educational experiences and competitive characteristic of medical students the limit of this research it can be easily seen. This restricts the applications of research findings of problem-based

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and self-directed learning to other educational levels such as elementary, middle school.

Further research is necessary to understand applications of problem-based learning in elementary education. Curricular elements of it and other possible factors also need to be searched to clarify possible factors that affect self-directed behaviors among elementary students.

CHAPTER II

REVIEW OF RELATED LITERATURE

This study consists of theory and review of existing literature of effects and elements of problem-based learning curriculum on students' self-directed learning behaviors. However, this section is denoted most specifically establishing background. The term self-directed learning has been around two decades and it was mostly used for professional education especially in medical education. In spite of the fact that the term self-directed learning has been around for a long time, there are limited number of research study about the elementary education level. Even though the positive findings of self-directed learning on different areas in the literature, there is no agreement among researchers about the definition of self-directed learning. According to Thomas, Strage, and Curley (1988) there are two basic types of self-directed learning behaviors: cognitive and self-management. On the other hand Scobie (1983) identifies five characteristics of self-directed learning: motivation, perceived relevance, planning, experiencing and assessing. Dirkes (1985) adds a new concept to self-directed learning, which is a continuum, and ranging from teacher direction to individual action. Taking yet another point of view, Zimmerman and Martinez-Pons (1986) define self-directed learning with three components. These components are meta-cognitive, motivational, and behavioral namely. " In terms of meta-cognitive process, self-regulated learners plan, organize, self-instruct and self-evaluate at various stages during the acquisition process. From a motivational vantage, self-regulated

learners perceive themselves as self-efficacious, autonomous and intrinsically motivated. In terms of behavior self-regulated learners select, structure and even create social and physical environments that epitomize acquisition (p.284).

Tough (1971) stresses the importance of self-directed learning as an ongoing and responsible process. The learner is also said to have the responsibility for the evaluation of outcomes (Knox, 1973). According to Knowles (1975) "self-directed learning is a dynamic process in which the learner reaches out to incorporate new experiences, relates present situations with previous experiences, and reorganizes current experiences based upon this process." Candy (1991) identifies self-direction as a process and a product. It occurs within a social context. Candy defines the term self-directed learning as students' ability to carry out activities that help them to control their learning.

The difference between the highest and lowest achieving elementary children has been found in the degree to which they become self-regulators of their own learning. "Academic achievement is one realm where self-regulated processes are assumed to be crucial (Bandura, 1982; Schunk, 1984; Zimmerman, 1983). It is because high achieving children engage different activities than low achieving ones such as goal setting, planning, self-monitoring, asking for help and memory strategies. Therefore, self-directed learning has been correlated many areas in the literature for instance cognitive ability, self-concept, and achievement. Student achievement is important, even it is a controversial educational outcome, it is claimed that achievement is heavily dependent on use of self-regulation strategies basically in competitive and evaluative settings (Zimmerman, 1983).

Zimmerman and Martinez-Pons (1986) conducted a study among 10th

graders from a high achievement and low achievement tracks to determine their

self-regulated learning strategies during class, homework and study. The

researchers determined fourteen self-regulated learning strategies based on the

literature. These strategies are checking their homework, getting help from outside

individual, and monitoring their own understanding. Researchers interviewed with

students from both tracks. They found that high achievers are different than low

achievers in terms of usage of those self-regulated learning strategies and apply

thirteen of those self-directed strategies in their learning process. The big

differences between high achievers and low achievers were found in regard to

their mention of the strategies seeking information, keeping records and

monitoring, organizing and transforming and seeking teacher assistance

(Zimmerman and Martinez-Pons, 1986). Zimmerman and Martinez-Pons also

concluded that low achievers used some of these strategies occasionally, but in an

inconsistent manner. These researchers also compared self-regulated strategies to

students' gender and socioeconomic status as a predictor of Metropolitan

Achievement Test (MAT) on both English and mathematic and they concluded

that self-regulated learning score was the best predictor in MAT achievement on

both English and mathematics (Zimmerman and Martinez-Pons, 1986).

Since achievement was found to be a result of teaching self-regulated

activities, Eisenman (1988) predicted a relationship between cognitive ability and

self-directed learning in children. Results of a Self-Directed Learning Readiness

Scale and Cognitive Ability Test indicated that no significant relationship exist between the self-directed readiness and cognitive ability.

Hudson (1986) searched for factors that indicate self-directed readiness among fourth and fifth grade students and their teachers. Students filled out self-report questionnaires on eight items and their teachers rated those students on the same items too. Even though the teachers' ratings indicate the opposite no differences were found among regular and gifted students' self-directed learning readiness. The purpose behind teacher ratings is to check the dependability of teachers' ratings of students' self-directed readiness and concluded that teachers may not accurately evaluate students' self-directed readiness. It was concluded that teachers should not believe that IQ equals self-direction; therefore they need to direct and behave gifted students in accordance with it. And also being a left or right hemisphere dominant was not found as a self-direction readiness indicator. The relationship between the self-concept and self-directed learning was found.

In Hall-Johnson's research, self-concept was found to be a readiness factor of self-directed learning behaviors (Hall-Johnson, 1985). However, this research was carried out among college students rather elementary. Corno and Rohrkemper (1988) found that children with negative self-concept were affect in their own behaviors and their behaviors, in turn, affected their self-concept. This finding also supports a positive correlation between the positive-self concept and self-directed readiness. McCombs claimed that, " Not until students' developed positive self-identity and this self-identity supported by successful learning experience they develop motivation to be self-directed learners". This idea also

indicates the effects of intrinsic motivation on the repetition of same behavior. According to McCombs, first a student develops a positive identity, and then successful learning experiences reinforce and support that positive identity which begins self-motivational process and that in turn leads to motivation to be self-directed learners. Purkey (1978) and Coopersmith (1967) reached the conclusion that when students feel intrinsic reinforcements such as pleasure, satisfaction from a task their tendency to repeat that task is increases. Besides, as the definitions of self-directed show that intrinsic motivation is one of the self-directed behaviors.

Self-efficacy is a factor that its effect on motivation has been searched. Self-efficacy means one's beliefs in own capabilities to motivate, to activate cognitive resources in a given situation so that he or she can determine future action. Bandura (1989) writes: " people who have a high sense of perceived self-efficacy in a given domain think, feel, and act differently from those who perceive themselves as inefficacious. For example, people who doubt about their capabilities shy away from difficult tasks" (p.731). On the other hand people who have high sense of efficacy show different characteristics than people who have low self-efficacy.

In another study, different instructional methods teacher directed, small group and seatwork were compared in terms of their effects on students' self-regulated behaviors. Five self-regulated behaviors were compared. These were attention to instruction, seeking help, monitoring progress, organization and meta-cognitive talk. According to Schunk (1990) students' ability to attend instruction is important indicator whether students direct their behavior toward learning tasks.

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Sometimes the instruction itself may not be clear for students; therefore it is also

important for students to look for help about instruction either from a teacher or

from peers. However, in order to seek for help, students must first recognize that

they need help (Newman, 1990; Newman & Goldin, 1990; Ryan & Pintrich, 1997;

Van der Meij, 1988; 1990). On the other hand, there are different factors that

affect students' help seeking behavior. Not only the friends, but also a teacher is

an active factor in students' help seeking behavior. According to research

findings, students think that other students and even the teacher perceive looking

for help is a weakness (Paris & Newman, 1990). Another listed self-regulated

behavior is students' ability to monitor their own learning. Checking a work,

detecting errors and adjusting strategies (Pressley & Ghatala, 1990; Schunk,

1986). The meta-cognitive talk that is listed as fifth self-regulated behavior an

important self-regulatory behavior. Besides meta-cognitive behaviors, students'

verbalization about their thinking gives important clues about their current level to

teachers. Unlike teacher directed and seatwork instructional methods students in

social context in a small group instruction supports meta-cognitive awareness and

talk (Meloth & Deering, 1994). In addition to this other students' thinking process

may be a guide for students in the small group. In their comparison of three

instructional methods Meloth and Deering (1994) found that small group

instruction fosters the developments of self-regulated behaviors among third

graders. Students in small group instruction are likely to monitor their own

learning to talk about their thinking, to ask for help and to perform more meta-

cognitive talk. On the other hand, students are seemed much more organized in

teacher directed instruction than in small group and seatwork condition. These

findings are clearly contrary to the development of self-directed learning

behaviors of children. However, under the teacher directed instruction, social learning theory supports that self-regulated performance of them can be improved through teachers' direct and explicit instruction of learning strategies (Cardelle-Elawar, 1992; King, 1991; Meloth & Derring, 1994).

Developmental studies on young children's self-regulated behavior indicate controversial findings. Some researchers claim that students learn and develop self-regulated behaviors not until middle grade level. However, "at age 5 children are believed to have developed an understanding of mental states as representations and of causal relations among actions, beliefs, experiences with the world, and mental representations"(Glaubman, Glaubman & Ofir, 1997). In order to test this finding, Glaubman et al. (1997) taught active processing theory and meta-cognitive theory, which are self-questioning strategies and looked its effects on kindergarten students' story comprehension and development of self-directed behaviors. According to literature self-questioning is an active strategy that establishes and promotes understanding (Dillon, 1988; Gavelek & Raphael, 1985; Singer & Donlan, 1982) and support independence and development of self-direction during learning process (Graesser & Person, 1994, Palincsar & Brown, 1987). In the literature, unlike older students, young ones ask many questions to gather knowledge. The decrease in older students' self-questioning behaviors were explained as their focus changes from knowledge seeking to social functioning (James & Seebach, 1982; Moch, 1987; Tizard, Hughes, Carmichael, & Pinkerton, 1983). There is a decrease in quantity of self-questioning during the years of early schooling (Moch, 1987; Vandenberg, 1984). Moreover, Dillon claimed that self-questioning behavior almost disappears by later school years (Dillon, 1988). The

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decrease in students' self-questioning behavior could be because of instructional treatments? In order to test this question Gaubman and collages taught two questioning strategies namely active processing theory and meta-cognitive theory to compare students' story comprehension, self-questioning and self-directed behavior. They concluded that students, who were taught meta-cognitive theory produced more quality questions, comprehend the story better and show self-directed learning behavior than other group of students. Even though positive effects of meta-cognitive training on self-directed behavior were found, there is a concern about kindergarten students' meta-cognitive functioning.

Hwang and Gorrell (2001) looked for the awareness of kindergarten students' of self-regulated behaviors. Children were required to carry out a task and after that they had four years old children watch two models on solving the same problem one successful and one unsuccessful and interviewed with children in order to determine their awareness of self-regulated learning behaviors of others. Both successful and unsuccessful children were aware that the models' planning process and evaluate them. On the other hand important difference were found between successful and unsuccessful children with respect to their view about the models' behaviors. Unlike unsuccessful children, successful ones were different in their awareness of models monitoring and thinking process, cognitive states and able to give reasons for models' actions. It was concluded that the children as young as four years of old were found to aware of important elements of self-regulated learning behaviors.

Lane (1993) obtained data among 5th graders' use of self-directed learning strategies and self-directed perceptual skills by using self-directed learning readiness scale and self-regulated learning schedule. Students were trained about self-directed behaviors and learning strategies. It was concluded that 5th graders can be taught self-directed learning skills and most children doubled their learning skills.

Although lack of number of research about long term benefits of self-directed learning among elementary students Weikart, Epstein, Schweinhart and Bond (1978) compared three early childhood curriculum high/scope model, distar model and nursery school programs in terms of student' intellectual and scholastic developments. In distar model teachers initiates the activity and students respond, in high/scope model both teachers and students initiates the activity and work together on it, and in nursery school child-centered approach in which students initiate activity and teacher respond was used.   They found no difference between the three. They indicated that poor children benefit both intellectually and scholastically from the high quality preschool curriculum. But, longitudinal research done by Schweinhart, Weikart, and Larner (1986) comparing three preschool curriculum revealed changes on students' school achievement and IQ in a positive manner. Students from nursery programs showed lower rates of juvenile delinquency and related problems as compared to distar model.

All of above findings indicate the positive effects of self-directed learning behaviors among elementary students' achievement, cognitive ability, and self-identities. As a result, it is important to determine factors and environments that

lead to development of self-directed learning behaviors among students. Problem-based learning is claimed to improve students' self-directed learning skills. Problem-based applications among elementary and middle grade students were done in the combination if problem-and project based learning. Students in problem-project based learning developed ability to understanding of learning issues, determine need for further learning, evaluate their project and make necessary changes. They gained self-assessment skills that help them to monitor their learning and find resources when it is necessary (Barron et al., 1998).

A student who shows self-directed learning skills are able to realize need for further learning, able to define what needs to be learned, able to plan and operationalize his or her learning, develop realistic learning objectives and a plan, has time management skills, differ in his or her knowledge processing strategies, able to reach necessary literature and do this in an efficient manner, evaluate the resources and able to evaluate his or her own knowledge and self-directed learning skills.

Problem-based learning is a method believed to develop self-directed learning strategies among its students. Problem-based application in elementary education basically used with combination to project-based approaches. Students in problem-project based condition first meet the problem and then start their actual projects. The problem given to the student were directly related their actual project. Moore, Sherwood, Bateman, Bransford, and Goldman (1996) and it was concluded that experimental group who were given a problem before their project created more quality projects that control group. Moreover, students learned

assessment of their project and learned to make necessary changes. Teachers gave students nondirective feedbacks about their project and directed them to solve the problem of their project by checking other multimedia devices (SMART). Interview results show that each student made at least one revision based on given feedback. Therefore, students were given responsibility of their learning. Researchers explained that students in problem-project based condition helped them to see important considerations in their work and alternatives. The behaviors of students indicated that the take responsibility of their learning and showed self-directed habits.

In problem-based environment in medical education students first given a problem, and, in a small tutorial group, they discuss and analyze the problem with the help of tutor so that they can understand the basic mechanism underline the problem. After the discussion among the group members about the problem students try to provide solutions and create relevant hypothesis to that problem by using their prior and limited knowledge. As a result of discussion in the group they determine further issues needs to be clarified for the understanding and solution of the problem. Further topics form students' further learning issues.

Those student generated learning issues are claimed in the literature as a basic element in the problem-based learning that affect the development of students' self-directed learning skills. As proposed in self-directed learning model, in problem-based learning after students assess their knowledge relative to the problem they develop learning issues. The generation of learning issues by students is assumed to stimulate the development of self-directed learning skills

(Walton & Matthews 1989; Blumberg et al. 1990). Therefore, the relationship is expected between learning issues and self-directed learning skills. Dolmans, Schmidt and Gijselaers (1995) looked for the relationship between student-generated learning issues and students' independent learning during self-study. They compare the learning objectives produced by medical students and faculty, students' time spent on that learning objectives and their mastery of those objectives, and finally qualitatively compare both learning issues and topic. Even though they expected positive correlations between learning issues and self-study, they came up with moderate negative correlations between the two. They concluded that what students actually do might not only be determined by their intention. Student generated learning issues are produced by group discussions may not be the only source on which students base on their self-study decisions. However, there are some other elements such as tutor guidance, additional curricular activities, learning resources, lectures might have an effect on students' self-directed learning behaviors (Dolmans, Schmidt & Gijselaers, 1995).

Further research questions arose; what might be the other curricular elements of problem-based learning that cause development of self-directed learning strategies? Lectures, effect of tutor, content to be tested, and general teaching objectives may have an impact on students' self-directed learning behavior. In order to determine other curricular elements that affect students' self-directed learning behavior Dolmans and Schmidt (1994) first set up interviews with students and based on these interview scripts developed a questionnaire. They then administered that questionnaire to medical students in the first four curriculum years. They tried to determine what elements of problem-based

learning might affect student' self-study and to what extent they play role over

students. They organized the questionnaire using six topics: the influence of

discussion in the tutorial group, influence of the content tested, influence of course

objectives, role of lectures, influence of tutor, and selection of reading material.

The findings indicate that, except that the effect of discussion in the tutorial

groups, other elements lose their effect on students' self-study habits as students'

progress through the curriculum. As students gained experience in problem-based

learning they develop better and clear learning issues. That explanation also

makes it clear that students become better self-directed learners as they progress

through the curriculum. They also found that first year students mostly depend on

lectures, content to be tested and literature cited as a reference list for their self-

directed learning skills. Overall, these findings show that not only student

generated learning issues, but also other elements, such as content to be tested,

lectures, tutor, course objectives, reference literature have an effect on students'

self-directed learning behavior (Cognition and Technology Group at Vanderbilt,

1992; Barron et al., 1998).

Classical problem-based learning has been criticized as a being too much

student directed. Teachers claim that some students have not the ability to

determine appropriate learning objectives and study individually, at least at the

beginning. Besides, many students and faculty believe that there is additional and

important content should be mastered even though it does not arise from the group

discussions (Blumberg, Michael, and Zeitz, 1990). Moreover, advocates of

traditional instructional methodology argue that in terms of delivering knowledge

most effectively and efficiently to the students lecture is the best way. These

criticisms have given rise to different research questions; whether or not students develop self-directed learning behaviors in a partially teacher directed curriculum. So, Blumberg and Michael (1992) looked to find an answer to this question in their research. They collected data from students' self reports, library circulation and student and faculty perceptions about students' self-directed learning skills. They concluded that students in a mixed problem-based curriculum developed self-directed learning skills in spite of the fact that significant teacher based curricular components. They basically stress the importance of essential elements of PBL, feedback and reinforcement from peers and tutor and consistency among curriculum elements in developing self-directed learning behaviors among medical schools.

Blumberg (Evensen & Hmelo, 2000) mentioned Rosenfeld's study (1995). He searched how and how often medical students use and apply faculty generated learning objectives and he found out that medical students did not use faculty generated learning objectives prior to small group discussion. On the contrary they apply those learning objectives at the end in order to determine whether or not they included all the mentioned learning issues.

Schools that have problem-based curriculum apply and use student generated learning issues differently. Blumberg, Michael, and Zeitz (1990) interviewed with faculty in PBL curriculum use universities to define how much student generated objectives were taken into account and they found that 5 of the 7 medical universities student generated learning objectives serve as a base. They further look and compare behavior of students in different programs in which

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student generated learning objectives are used or not used in terms of their extra material usage and contact with librarians. They concluded that unlike students in traditional curriculum that are based on faculty generated learning objectives, students in problem-based programs that are based on student generated objectives used more extra reading materials and had contact with librarians. Besides, students in traditional curriculum which faculty-generated learning objectives were used as learning objectives was reported that decrease in motivation to become self-directed learners by their faculty.

Self-reported time spent in independent study is considered as an indicator of effort (Schmidt, Van Der Arend, Moust, Kokx, & Boon, 1994). Carroll (1963) stated, "Individual students would master instructional objectives to the extent that they are allowed and are willing to invest time needed to learn". Students in problem based learning state their own learning issues and learn what they think are relevant. Therefore, they are more motivated toward learning or self-directed. As a result, there are expected to spend more time to self-learning activities and they reported that they spent more time for self-directed learning activities. Blumberg and Michael, (1992) compared students in traditional and PBL curriculum with respect to their self-study times. Based on self reports findings they concluded that both students in regular curriculum and PBL curriculum are same in their educational activity time per week, but what they were different is PBL curriculum students' time spent in nonscheduled or SDL activities (Blumberg & Michael, 1992).

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In their research, Williams, Saarinen-Rahikka and Norman (1995) were interested in time utilization in self-directed learning among PBL students. They looked amount of scheduled and non-scheduled educational activities and its increase and decrease as students spend time in their curriculum. They found that as students' progress in their curriculum as their self- study time decreases. Unlike Gijselaers and Schmidt (1992), they attributed that decrease to students' greater efficiency in the curriculum. Students' anecdotal information also supports their hypothesis; as students get familiar to the curriculum they become good at in using library and human resource, and better at determining the depth of required information.

Gijselaers and Schmidt (1992) looked for the relationship between the amount of instruction time and students' time spent on self-study among medical students. They concluded that increase in the instruction time leads to diminishing increase in self-study time. They attribute decrease in study time to increase in instructional time. Allocation of unscheduled study time to is also found as a factor of tutor's subject matter knowledge and experience. A tutor who has a subject matter knowledge and experience about problem helps students to generate better questions in terms of depth of knowledge and better learning issues about a problem. Therefore, these help students while searching the topic and increase unscheduled study time.

Schmidt et al. (1993) also found positive effect of tutor's subject matter experience on students' increased study time. The difference was bigger when students' time in PBL environment increases. Third year medical students

reported spending 15% more time on self-study, whereas fourth year students reported 47%. Although the decrease in unscheduled time expected as students gain experience through problem-based curriculum, when its effect combined with tutors' subject matter experience study time of students increase. Eagle et al. (1992) also found that medical students guided by a content expert "produced more that twice as many learning issues for self directed learning and spent almost twice the amount of time on self study as did students guided by non-expert tutors". (Eagle at.al, 1992) Schmidt and Gijselaers claimed that tutor's behavior is one of the three factors that affect small group together with students' prior knowledge and quality of problems. On the other hand Barrows proposes that role of the tutor in the small group is not to convey knowledge rather facilitating the learning. Therefore, tutors are not necessarily being a subject matter expertise. He also claims that process-facilitation skills are important for the learning of the students. Studies about effect of tutor on students' achievement and self-study show contradictive findings. Eagle et al. found that content expert tutor cause increase in students' number of learning issues and time to self-study. Davis et al. found increase in students' performance on achievement test as a factor of tutor expertise. On the other hand Harvard studies and Silver and Wilkerson show negative effect of subject matter expertise on student achievement.

In a study done by Silver and Wilkerson (1991) the behaviors of an expert tutor in a small group discussion were examined different in a way. The tutors talked and suggested agenda which in turn caused students take less parts in student directed discussions and collaborative learning. Other researchers had found no effect of tutor subject matter expertise on students' achievement and

self-study. However, Schmidt et al. (1993) and Eagle et al. (1992) found positive effects of tutors' subject matter expertise on both students' achievement and self-study time. Mayo, Donnelly, Nash and Schwartz tried to determine the qualities of effective tutors. They concluded that effective a tutor is the one who helps students to clarify important learning issues and provides feedback.

Information seeking skills are central to the problem-based curriculum, which emphasizes self-directed learning and acquisition problem solving and lifelong learning skills (Rankin, 1992). Seeking, obtaining, and evaluating resources are also other important elements of self-directed learning. Students in PBL curriculum are expected to be a better knowledge consumer than regular curriculum students.

Blumberg and Michael (1992) compared traditional and PBL curriculum medical students with respect to their library resource usage and they found significant differences between two groups of students. Students in PBL curriculum mostly used textbooks, informal discussions with faculty or peers, and journal or other books as a basic resource. Since students in PBL curriculum are not assigned any type of homework, these resources were called self-directed learning resources by the researchers. On the other hand, students in traditional curriculum depend mostly on teacher-centered resources, which are faculty prepared course syllabi, lecture notes and textbooks. In addition to this, PBL curriculum students reported using all library resources weekly and doing searches two to three times a month (Blumerg & Michael, 1992).

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Self-directed learners must able to find variety of resources related with their learning objectives and evaluate those resources critically. Thus, it is expected that students in problem-based curricula be a better library users than conventional curricula students and able to evaluate the resources. Studies showed that resource use is one of the major differences among problem-based and conventional curriculum students.

Marshall, Fitzgerald, et all. (1993) found that problem-based curriculum students use library more often than traditional curriculum students and they use library more frequently, longer periods of time, as a place to study and to meet with other students. Problem-based curriculum students mostly used library journals; reserve or short-term loan materials, photocopy services and audiovisual materials. They were also found to purchase more textbooks than their traditional curriculum counterparts.

In another study, Rankin (1992) compared four medical undergraduate schools: two with two curricular tracks (problem-based and traditional), one problem-based learning curriculum, and one traditional. It was concluded that problem-based learning students show differences in frequency of their library usage, prefer different resources that support independent learning process, have less problems in library usage and obtain information seeking behaviors. However, Rankin found no difference in the range and variety of information resources chosen by the students and this is different as it was mentioned in the literature. (Rankin, 1992)

Finding relevant sources for learning goals is important, but assessing the quality of information is another important skill that self-directed students should have. In order to check students' ability and to evaluate students' most used resources, Blumberg and Sparks (1999) students write their most used resources, how frequently they use it, and answer why they use it. As students progressed through the problem-based curriculum their sources and ability to evaluate critically of that sources changed. (Blumberg&Sparks, 1999*)*

Learning strategies that students use change according to the demand of the situation (Candy, 1991). Self directed learners actively choose what to learn, involve in learning issues, take responsibility of their learning, and have control over their learning. The research suggested that this means that they have more motivation and use conceptual skills (deep-level of processing) in their learning (Candy, 1991). "It is assumed that active engagement in the pursuit of knowledge and skill facilitates knowledge acquisition and knowledge organization (Glaser, 1991). Newble and Clarke (1986) compared PBL students and traditional curriculum medical students in their ratings of themselves on level of processing and found that students in PBL curriculum rated themselves higher on deep level of processing items and lower on superficial items; whereas, students in traditional curriculum rated themselves higher in superficial processing items. Coles (1985) supported the findings of Newble and Clarke with his research.

Mitchell (1994) looked for four aspects of learning behaviors and compare learning behaviors of problem-based and conventional curriculum medical students. He concluded that unlike traditional curriculum students who used

memorization, PBL curriculum students used conceptualization as a learning skill most.

A seemingly supportive study by Blumberg and Daugherty (1994) compared the adequacy of traditional curriculum to problem-based curriculum in terms of preparing students to short term goals such as passing an examination and long-term goals becoming a physician. Blumberg and Daugherty (1994) found that unlike problem-based students, traditional students feel that there is no relationship between the activities they have done and passing examinations. For instance, there was no relationship indicated between learning experiences that they have done and becoming good physicians. Activities valued most by problem-based students, either for passing an examination or for becoming a good physician, were also those rated highest by the faculty (Blumberg & Daugherty, 1994). In order to determine long-term effects of PBL on students' self-directed learning graduates of McMaster University compared to graduates of Toronto University, which is a traditional curriculum university, on knowledge about management of blood pressure. It was found that graduates of McMaster University maintained their knowledge better than traditional curriculum graduates.

It should be noted that not much research has been carried out to determine long term effects of self directed learning. Blumberg and Michael (1992) compared library data of book-borrowing rates both problem-based and regular curriculum graduates. They found a difference in book borrowing rates of both graduates. Shin, Haynes and Johnston (1994) compared problem-based and

regular curriculum graduates in terms of their ability to update their knowledge on the same medical area after 5 to 10 years of their graduation. They found that problem-based graduates were much more aware of new developments and new methods used in their area. The limited research base about long-term benefits of problem-based learning is not enough to conclude that the problem-based students are lifelong learners.

All these researchers and those studies seem to support to the idea that problem-based learning leads to development of self-directed learning behavior of students. Then also argued that PBL students are better self-directed learners as compared with their traditional curriculum friends. The purpose of this research is to determine curricular elements that cause development of self-directed behaviors of students.

CHAPTER III

RESEARCH

Societal changes demand huge educational reform. Students need to be changed from passive, receiving, conforming and teacher dependent types to active, knowledge seeker, free from teacher dependence, creative and happy type. Educating and teaching students to be self-directed learners through their learning process creates a student type that society demands. Problem-based learning is claimed to achieve the defined student types and it is an instructional method, which uses problems to facilitate students in a small group-learning environment under the guidance, and help of a tutor or facilitator to solve problems at the same time achieve its goals. Contrary to common belief, self-directed learning is a result of problem-based curriculum in which students actively involve in their learning.

Even though developments of self-directed behaviors as a result of problem-based learning is proposed to overcome the pitfalls of undergraduate medical education or professional education, elementary education faces problems that have similar characteristics that of undergraduate education problems indicate the necessity of teaching self-directed learning skills to elementary education students too. Students in elementary education are unable to integrate different subjects, unable to apply acquired skills to new situations, because of different characteristics and demands of elementary and middle grades increase need to prepare elementary students to middle grades and for further education (Bennet, 1986). Thus they need to learn study skills in early grades (College Board, 1985;

National Commission on Excellence in Education, 1983) and spent some time

doing quality out of schoolwork (Bennet, 1986; National Commission on

Excellence in Education, 1983). This doesn't mean that elementary students don't

know many subjects, but indicates the difference between possessing knowledge

from inability to apply it and transferring that knowledge to novel situations.

Self-directed learning behaviors of elementary students are different from

those of college students. Paying attention to instructions, taking part in

discussion, monitoring their own progress, organizing and doing their homework

and class assignments, reading, preparing for the test, seeking instruction when

they have difficulty, and demonstrating an awareness of their own thinking are

called self-regulated behaviors in elementary classrooms (Cross & Paris, 1988;

Loper, 1980; Newman, 1990; Schraw, 1994; Schunk, 1986). When students are

asked to learn on their own, the necessity of self-directed learning behaviors

appears. For example, when students need to get ready for an exam, they need to

do the required reading and perform some specific activities to meet the demands

of the task. These activities may include allocation of time, decoding of words,

comprehending the context and making the studied context memorable; all of

them are classified as out of class activities (Thomas, Strage, Curley, 1988).

Besides self-regulated characteristics of some out of class activities, there are

some in class activities that require students to show self-directed behaviors

during classroom teaching; for instance when having a difficulty in listening a

presentation asking for help which means self-monitoring, taking notes about

difficult topics, looking and using both human and material resources to better

grasp the topic. These activities basically indicate that self-directed learning

activities are learner initiated and regulated activities (Thomas, Strage, Curley, 1988). Other researchers defined as autonomous learning activities (Thomas & Rohwer, 1986), studying (Anderson & Armbruster, 1984), meta-cognitive activities (Brown, 1978), self-regulated learning (Corno, 1986), intentional learning (Bereiter & Scardamalia, 1985) and learning strategies (Weinstein & Mayer, 1986).

According to the literature, different instructional methods affect students' self-regulated behaviors in a different manner. For example, small group instruction increases in active learning and peer teaching and the cognitive levels of students in small group may be similar or the same which makes modeling self-regulated behavior more effective way. This is what social motivation theories support (Antil et al., 1998). Therefore, instructional methods commonly used elementary education must be changed in a way that self-directed behaviors of students to be fostered and supported.

With the adults in medical schools, reaching and achieving the objectives medical school problem-based curriculum is depending on some aspects. These variables are; "the design and format of the problems used in PBL, the degree to which learning is teacher directed or student directed and finally the sequence in which problems are offered and information is acquired" (Barrows, 1986). The problem is used to explain a condition. Therefore it includes the facts and evidences that will further inquiry. Generally, in conventional curriculum, teachers are the decision agents in terms determining the knowledge to be learned and its extent. However, Barrows claimed that locus of control is another factor

that affects achievement of objectives in problem-based learning. Based on the degree to which variables are applied in problem-based learning design, Barrows (1986) determined five types of problem-based learning:

1) Lecture based environment in which lectures are used with complete problems,

2) In case-based lectures students first given the complete problem and then the teacher gives lecture, in case method students given some responsibility and search the complete problem to prepare a discussion,

3) In modified-case partial problem provided and then students direct the learning process,

4) In problem-based learning full problem is provided and students take the responsibility of their learning and complete full self-directed learning and

5) In closed-loop or reiterative type after students finish all self-directed activities they are asked to look to the problem with their increased knowledge base and evaluate the learning process they go through.

Barrows (1983) also claimed that, in the last type, self-directed skills would be the highest among students.

Students who attend problem-based curriculum claimed that retain knowledge better than conventional curriculum students, transfer that knowledge to novel situations, more motivated than their counterparts and show self-directed

learning behaviors such as ability to define their learning objectives, to monitor

their learning, to search and use both human and material resources efficiently and

effectively, to evaluate that resources. Unlike the students in traditional

curriculum, students in problem-based learning curriculum are "not given the

material in lectures, they must study the material in more active way to make

meaning out of information. They often have to transform the material as

presented to answer their specific learning questions. This transformation process

to make meaning out of the information is an active learning process. The

discussions of the problems themselves, as well as the preparation for the

discussions stimulate deep level of processing" (Evenson & Hmelo, 2000 p.217).

Other researchers have claimed that positive effects of problem-based

learning are facilitated and achieved by small group activities. Schmidt identified

specific activities in the tutorial process that can be identified as elements

contributing to problem solving success. These are

1) Defining and analyzing the problem,

2) Brainstorming and formulating hypothesis,

3) Testing hypothesis,

4) Identifying learning issues and

5) Sharing of knowledge that cannot be achieved through an individual
   study or achieved only limited (Schmidt, 1993).

Theoretical Bases of Problem-Based Learning

Problem-based learning reflects the theoretical perspectives, which is well

supported by cognitive science and particular contributions of Dewey, Bruner and

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Piaget (Schmidt, 1983,1993; Norman & Schmidt, 1992). Within the cognitive science domain problem-based learning reflects a rationalism (information processing) view of learning (Schmidt, 1983,1993; Norman & Schmidt, 1992; Albanese & Mitchell, 1993) and a constructivist view of learning (Savery & Duffy, 1994).

According to rationalist perspective of learning individuals acquire knowledge through their own cognitive process. Dewey (1929) believed that learning is an individual event therefore knowledge needs to be mastered by the learner, not just transferred through somebody from outside. Dewey (1938) pointed out that knowledge cannot be simply transferred form one individual to the other. In order to construct knowledge base an individual must actively engage in cognitive processes. Learners also have knowledge structures in their mind that has been formed through their experiences and that existing cognitive structures directly affect understanding and comprehending easily new knowledge. Bruner seemed that to support the view which he suggested that the knowledge is organized with respect to interests of an individual and this cognitive structuring makes that knowledge much more easily accessible from the individual's memory as cited in Slavin, 1994. From information processing approach to learning acquiring new information basically depend on three principles: activation of prior knowledge, encoding specificity, and elaboration of knowledge. Prior knowledge that a student has affects structuring the upcoming information. As Schmidt (1992) pointed out " learning by its nature has a restructuring character". Prior knowledge and its structure in the long term memory will determine what is understood from a new information and this in turn will define what is learned

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from it (Rumelhart & Ortony, 1977). Therefore, it is very important to activate

prior knowledge that is related to new learning material, so that better learning

results will be achieved. "As a result the amount of prior knowledge available

determines to what extent something new can be learned" (Schmidt, 1993). Mayer

and Greeno (1972) claimed that instructional methods differed with respect to

their ability to activate necessary prior knowledge. Mayer (1982) stated that

instructional methods would be successful in students' processing of new

information to the degree that they activate students' prior knowledge. Small

group discussions in problem-based learning are a way to facilitate prior

knowledge. Thinking and discussing about a solution of a problem is believed

activate prior knowledge, which leads to increase in comprehension of new

information.

Schmidt has interested in effects of activation of prior knowledge through

small group discussions. He carried out two experiments and in both of them

learners are given a problem and asked to explain the problem with respect to its

principles and underlying mechanism which also means that students are asked to

construct an explanatory model using prior knowledge activated by the problem

(Barrows & Tamblyn, 1980; Schmidt, 1982; Schmidt & De Volder, 1984). The

first experiment was done to determine the effects of analysis of problem on

activation of prior knowledge and in the second one the effects of prior knowledge

on processing a text were searched. He concluded that problem analysis through

small group activate previously learned material and students who are given the

problem related with prior recalled knowledge and proposed twice as many

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propositions as a solution to the problem as did the control group (Schmidt et all. 1989).

In the second experiment Schmidt and his associates (1989) looked for the effects of activation of prior knowledge on comprehending a text and also compared the result of subjects who do have specific prior knowledge to subjects who do not. It was found that students with prior knowledge remembered more than others. On the other hand, students who do not have prior knowledge got much benefit from problem analysis prior to text comprehension. This finding is explained as results lacking the necessary knowledge easily see their knowledge discrepancy thus problem analysis has greater impact on them (Schmidt et al., 1980). However, the activation of prior is not the only factor that affects understanding and remembering that information. Therefore, prior knowledge a student has needs to be activated by cues in the context of which the information is being studied (Schmidt, 1993). For example a title may be a clue in facilitating the prior information that a student has. As a result, the new information is related and organized in accordance with the existing knowledge structure, which leads to better memory.

Another cognitive principle is also related with knowledge and its structure. Knowledge a student has a structure and this structure contains propositions. A proposition is a statement that contains two concepts and their interrelations and no concept has exactly the same knowledge about a certain topic in an individuals' mind, which is called idiosyncratic (Schmidt, 1993). The students' ability to understand new information strongly depends on the quality of

existing those structures. The ability to use that existing knowledge in the future is affected by the number of relationships between concepts, it detail and its way of organization (Schmidt, 1993).

Encoding specificity is another condition that facilitates learning. A situation in which a new material is learned resembles the other situation that learned material would be applied lead to better learning outcome. Students in problem-based learning gain knowledge through patient cases that is a situation that they will apply that learned knowledge in the future. Elaboration of knowledge is another principle that affects gaining new knowledge. As cited in Schmidt (1983), Anderson & Reder, (1979) found that information is better understood, processed, and retrieved if students elaborate on that information. In the elaboration process the learner create the relationships between two concepts. As a result of elaboration multiple redundant retrieval paths are created in knowledge network in the brain, which in turn facilitates the retrieval of a concept from memory and increases the chance of retrieving required and necessary information. Schmidt (1983) mentioned the works of Anderson & Biddle, (1975), Peper & Mayer, (1978), Rudduck, (1978), Bargh & Schul, (1980) and Wittrock, (1974) in his article. He wrote that when you consider educational situations, there are many ways that a student can elaborate on information such as by answering questions about a text, taking notes, discussing the subject matter with other students, teaching peers, writing summaries, and formulating and criticizing hypotheses about a given problem.

Context is another element affects activation of prior knowledge. Learning knowledge in an environment that similar to environment in which knowledge will be applied and remembered in the future results in better performance in remembering that knowledge. It is defined as contextual dependency of learning. Dewey indicated the importance of learning gained through interaction with real life problems and fostering independent learning on children. All of the cognitive principles are achieved through the process of problem-based learning and which results in positive learning outcome.

The major theory for problem-based learning is called constructivism. In a simple and clear way constructivism can be defined as students' construction of knowledge according to their own understanding of the learning experiences. Savery and Duffy (1994) defined constructivism as continuous knowledge acquisition, building and reshaping it as result of an experience. From that perspective it is also claimed that learning is a restructuring of existing knowledge, which indicates the adjusting ability of learners. Therefore the meaning of teaching is not simply telling to students and learning is a continuous process according to constructivist perspective. Moreover, Shuell (1996) defined constructivism: "the learner does not merely record or remember the material to be learned. Rather he or she constructs a unique mental representation of the material to be learned and the task to be performed, selects information perceived to be relevant, and interprets that information on the basis of his or her existing knowledge and existing needs. In the process, the learner adds information not explicitly provided by the teacher whenever such information is needed to make sense of the material being studied. This process is an active one in which the

learner must carry out various operations on the new materials in order for it to be acquired in a meaningful manner". This definition stresses the importance of two words related with learners; first they are active in the learning process and the second they make a meaning from that knowledge. The constructivist view rejects the idea that students are passive in the learning process. Also the definition of constructivism indicates one aspect of knowledge; that is knowledge is subjective and unique for each individual because, no two individuals have the same and exact experiences. The problem-based learning environment has powerful effects on students learning when compared with traditional learning environment because it is based on constructivist perspective. First of all students in problem-based learning are given responsibility of their own learning and engage in self-directed learning so they are individually and actively engage in learning process to construct knowledge. In addition to this, small group discussion is a social environment through which students' learning and construction of knowledge facilitated. Some people believe that individual constructs the meaning that is individual of psychological constructivism and others believe that not only individual but also individual in interaction with social situations construct meaning. Thus, learning can be said have both individual and social perspectives. "In education constructivism has become an appealing alternative to traditional process-product educational practices because it seems to address the criticisms of current educational practices, and it promises to deliver higher levels of literacy, multiple forms of literacy, self-reliance, cooperation, problem-solving skills, and satisfaction with school." This small group also helps activation of students' prior knowledge, which is important in restructuring of new knowledge. Besides, throughout the problem-based learning process students are needed to show self-

awareness that is also stressed in constructivism. But, what does exactly problem-based learning mean?

According to Barrows, different educational organizations called different applications as problem-based learning; thus the definition of problem-based learning is controversial and meaning of the problem-based learning is not constant and clear among its users. Type of instructional design and skill of a teacher change the meaning of PBL. Barrows designed problem-based learning taxonomy ranging from lecture-based cases to closed-loop or reiterative problem-based learning and claimed that closed loop problem-based learning is the one in which SDL reaches high point.

Schmidt and Gijsealaers (1990) proposed a theoretical model for problem-solving learning and relationships among determined factors after a couple of research.

The problem has very important role in this process because its quality affects students' further learning. Therefore, the difficulty level of the problem and knowledge level of students must be considered very carefully. Too easy and too difficult problems don't produce aimed development. In the small group discussions students try to understand basic theory behind the problem and to solve it by pooling their knowledge. As a result of the discussions in the small group students' prior knowledge activated, thus future learning facilitated. Another important element in problem-based learning is tutor's effect on students' performance. Therefore, it is important to determine the skills that make the tutor

effective are very important. It is believed that the tutors subject matter expertise besides his or her social congruence which means interest in students' lives and learning constitute cognitive congruence that is "tutors ability to express himself or herself at the students' level of knowledge; using language of students, using concepts like students use to explain things" so that students easily get the meaning of the explanation. According to theory of effective tutor, the tutor should posses the social congruence skills together with necessary knowledge base and cognitive congruence (see figure 1).

Arrows indicate these relationships between the elements of problem-based learning. By this the developments of self-directed behaviors depend on many factors.

We can infer the self-directed learning from the words of John Dewey in 1918. He claimed that everybody has the potential for development and growth from the day they were born and education is an agency for that development. The teacher should guides students in this process but either interfere or control the process of learning (Dewey, 1929). From this perspective, the focus of learning is on the individual and self-development, with the learner expected to assume primary responsibility for their own learning (Knowles, 1975; Tough, 1971). The learners choose to assume primary responsibility for planning, following through and evaluating their own learning this makes different self-directed learning from learning occurs in formal setting (Candy, 1991).
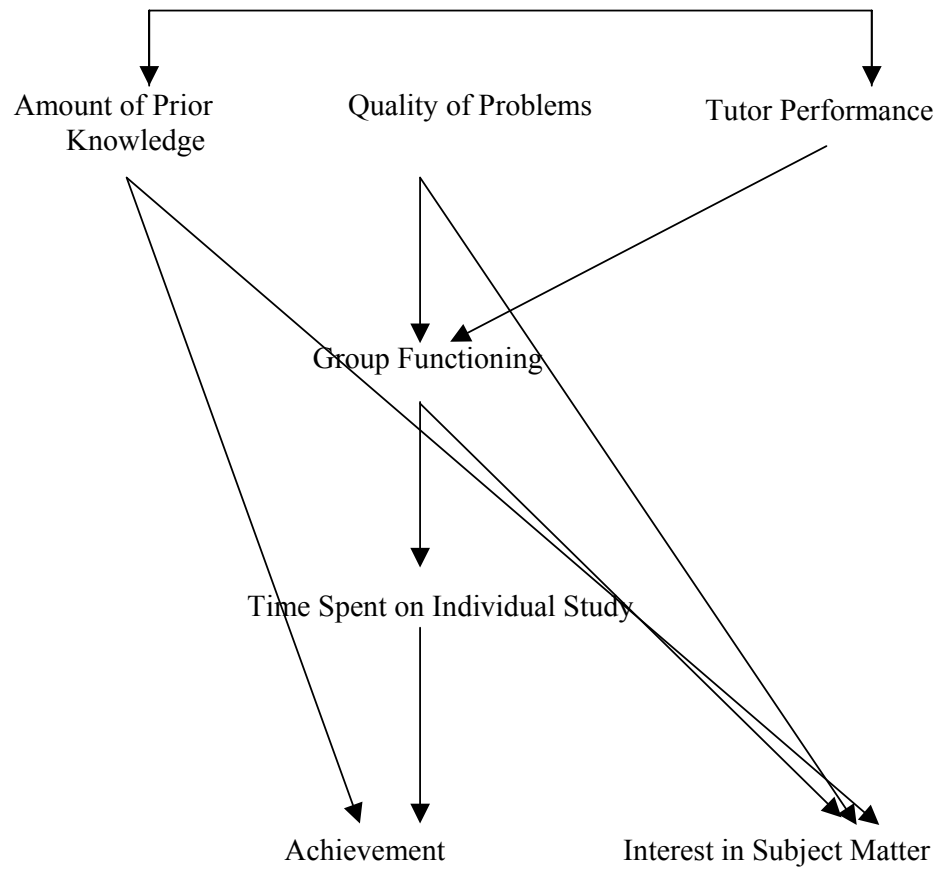
Figure 1.

Theoretical Model of Problem-Based Learning

(Schmidt & Gijselaers, 1990)

The active learning style of problem-based learning promotes self-directed learning strategies needed for lifelong learning (Bereiter & Scardamalia, 1989). Because of the discovery nature of learning in problem-based environment self-directed learning skills acquired as students manage their learning goals while coping with the problem they are trying to solve (Barrows, 1985).

The problem-project based learning studies done among elementary students also showed the importance of problems in students learning and development of their self-directed behaviors. So, Schwartz, Vye, Moore, Petrosino, Zech, Bransford and The Cognition and Technology Group at Vanderbilt identified 4 design principles of proble-project based learning. These are:

1. Learning-appropriate goals,

2. Scaffolds that support student and teacher learning,

3. Frequent opportunities for formative self-assessment and revision, and

4. Social organizations that promote participation and result in a sense of agency (Schwartz, Vye, Moore, Petrosino, Zech, Bransford and The Cognition and Technology Group at Vanderbilt, 1998).

These four principles are found important for acquisition of knowledge and development of awareness among students so they take more responsibility of their learning. While working on an activity students try to understand the relationship between the activity and underlying conceptual knowledge behind it. In the problem-project-based application necessary questions help students reflect

on the activity and make it easy to understand the material. Kilpatrick (1918) claimed that if the purpose is present, students' understanding is facilitated. The problems and projects are difficult for students to understand and achieve they need help which is called scaffolding. Scaffolding helps a child to solve the problem that is not possible to solve for him or her without help. In problem-project based approach both the problem and using contrasting cases serve as a scaffold for students. All of the scaffolds provided to students and project itself provide ways students to apply assessment. So, they can revise their project. Students in this approach actively engage in their learning process. Small group discussions are one way to from social organization. Hmelo and Lin (2000) cited Schwartz (1999) claimed that students in small group feel that they are contributor rather than idea borrower because that they see that their ideas are used in solving the problem. Their motivation is also increase as well. In project based approach outside audiences who were believed serve a control function also present. The overall principles of problem-project based approach support students self-directed behaviors.

In problem-based learning there are some characteristics, which are believed support the development of self-directed behaviors of learners.

1- The student centered nature of pbl,

2- Having students attempt to identify and solve a problem with their existing knowledge,

3- Identifying knowledge deficits and generating appropriate learning issues,

4- The independent research effort,

5- Critiquing the resources used for research,

6- Applying the new knowledge to the problem,

7- Collaborative reflection on sdl

These features of problem based learning was proposed to support and nourish the developments of students' self-directed learning skills (Evenson & Hmelo, p.229)

The first and the basic important elements of problem-based learning is its degree of student centeredness which is an opportunity given to the students in the classroom decision-making process. Cited by Lane (1992), Kruglanski (1978) claimed that students' contribution to the decision-making process cause higher quality engagement and output and most importantly students' motivation and effort to learning increase (Corno & Rohrkemper, 1985). Students in problem-base learning are given responsibility and actively construct their knowledge. Unlike the traditional curriculum, in problem-based learning students are responsible for their learning and actively join that process. On the contrary, the role of the students in conventional curriculum is to be a knowledge seeker. Thus, there is a clear role shifts of students exist in problem-based learning environment compared with traditional ones. Like students role, problem-based learning also requires change in teachers' role too. The teacher acts as a facilitator in the problem-based learning process whereas, teachers act as a knowledge source. Basically the teacher in problem-based learning first needs to be a model and scaffold the behaviors that students need to do by themselves as they progress through the problem-based curriculum. The teacher models the question asking and self-evaluation. For example, while students trying to underline basic mechanism behind the problem teacher asks, "what do you hope to learn" or "what more do you need to know?" Students then internalize these questions and

pose them to themselves in a meta-cognitive fashion (Collins, Brown, & Newman, 1989). This helps students to develop the ability to assess and understand themselves on their lifelong journey of learning and knowledge building (Bereiter & Scardamalia, 1989). Therefore, once a problem is given to students to work on it, they are asked to propose solutions for the problem by using their existing knowledge based. Since solving the problem is a difficult task, students work in a group and pool their knowledge base. Students' prior knowledge activated and elaborated as a result of small group discussions and analysis of the problem. Relevant problem discussions in the small group help students to construct of semantic network with contextual cues that they resemble the future context in which learning is applied.

Small group discussion and learning support the intrinsic motivation (epistemic curiosity) of students. However, the concern about the small group discussion is whether or not every student in the group gets benefit from it equally. Moust et al. (1986) showed the quantity of one's contribution to the discussion in the small group and its quality was unrelated to the achievement. According to Moust et al. the more silent students who were not active in the small group discussions were involved in a "covert elaboration" as they named. By analyzing and discussing relevant problems, students learn how to deal with problems in the future. That process turns students into independent, self-directed lifelong learners. Through analysis of the problem, students realize that they don't have enough information to solve it. In order to determine their knowledge deficient students need to evaluate their existing knowledge base and engage in a self-assessment process. Barrows and Tamblyn claimed that students in problem-

based curriculum learn to see gaps in their own knowledge and learn to evaluate their own strength and weaknesses. This knowledge inadequacy helps them to generate their own learning needs and to plan further learning, which is the third quality of problem-based learning. As Schmidt, De Volder, Moust, and Patel (1989) indicated, realization of having lack of knowledge base motivates students toward their learning and activates prior knowledge to help them to organize and understand easily the new information.

Once students realize that they do not have knowledge to solve the problem, they own learning issues, which direct them for further learning. This is also an important step in becoming a self-directed learner. Through this process they develop the goal orientation skill that they need to be mindful self-directed learners (Bereiter & Scardamalia, 1989; Ng & Bereiter, 1991).

After successfully completing this step, students move another step, which is also really important. That is students' independent research effort. Learning issues are searched so that students can obtain necessary and sufficient information to solve the problem. This step is important because students learn searching resources in an effective and efficient manner and using both human and other type of resources when necessary. As a result, students become flexible and adaptive learners.

However, students need not only effective and efficient use of both human and other type of resources but also critically evaluate those resources. Further, students decide how much and what knowledge is necessary to them in solving

the problem. That requires them to apply the gathered knowledge in a problem that is said as key feature of the problem-based learning. As couple of studies done by Bransford and friends "students who learn to facilitate an understanding of the relevance of information are more likely to develop contextualized knowledge structure that connect isolated pieces of information. Building such knowledge will facilitate access when relevant problems arise (Bransford, Sherwood, Vye, & Rieser, 1986). This contextualized information was found important in problem recognition and in monitoring problem solving.

After that, a reflection process comes. Reflection is a critical component of the self-directed learning process if students are to transfer their strategies and knowledge to new situations (Salomon & Perkins, 1989). Students reflect not only the acquired knowledge but also the whole self-directed learning process they go through. As the reflection process is done students recognize their strengths and weaknesses of their strategies, how effective they are and what further they can do to improve their strategies and skills. According to Lin and Lehman (1999) the types of reflection cause different impacts on the learning and transfer. So, students need to reflect on the effectiveness and quality of the whole process. As group members while students are sharing their knowledge among the others the reflection process goes in a collaborative manner through which they share and compare their thinking with other members of the group (see figure 2).

Assess knowledge relative to problems being faced

↓

Formulate learning issues

↓

Develop and implement plan to address learning issues

↓

Use new knowledge in problem solving

↓

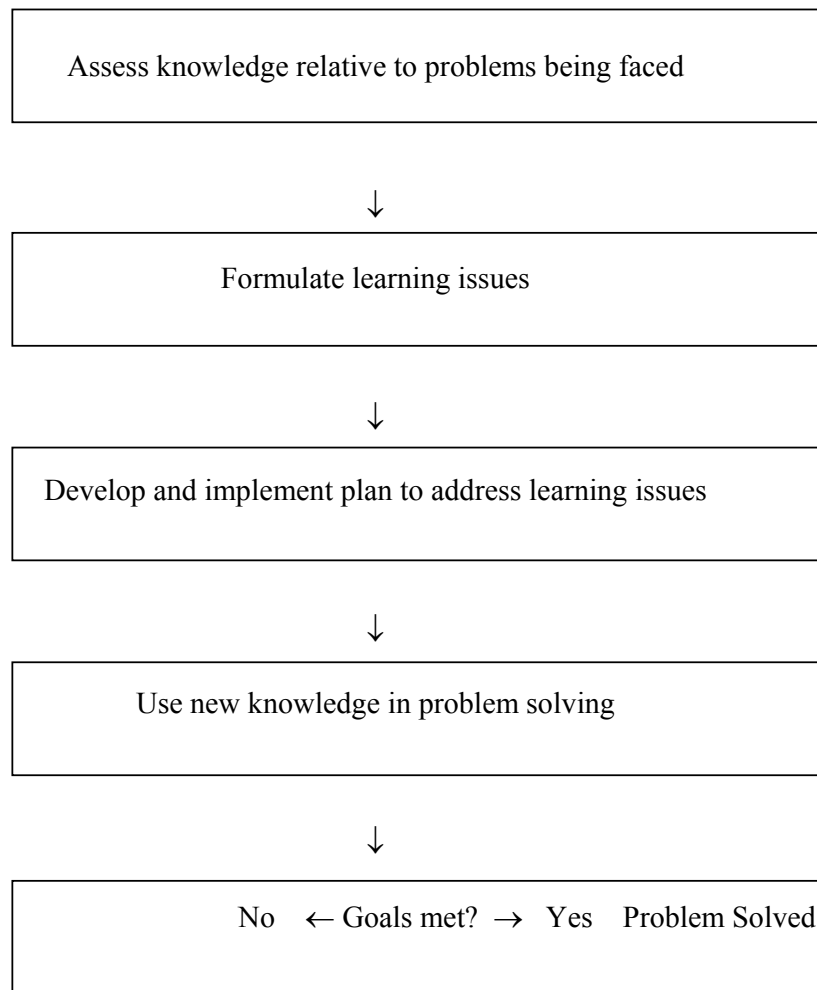| No ← Goals met? → Yes   Problem Solved |
|---|

Figure 2.

A self-directed Learning Model in Problem-based Learning

(Evensen & Hmelo, 2000 p. 229)

However, this proposed theory for the development of self-directed behavior might not be the complete story. According to Dolmans (1994) the relationship between determining learning issues and developing and implementing a plan in order to achieve learning issues. She claims that the relationship between the two is much more complicated than predicted. She concluded that students' plan that addresses learning issues may not be an indicator of their self-directed activities. She identified that the availability of the literature, motivation, the breadth of learning issues, self-assessment tests and other examinations have an influence on students individual learning behaviors. Her explanation of this finding is that the searching the literature may be a dynamic activity in a way that in search process students encounter different topics that interest them.

Theoretical Basis of Self-Directed Learning

Both the socio-cultural theories and information-processing theories of transfer form the theoretical basis of effects of problem based-learning on the development of self-directed learning strategies. In the mechanism of transfer, activation of previously learned material and it application to novel situations are important.

The information processing theory of transfer:

The information processing theory of transfer predicts that "the transfer probably depend on how a memory search initiated, the kinds of memory nodes

accessed, and the extent of connectedness to other nodes in memory" (Salomon & Perkins, 1989). Also according to this theory students' ability to apply knowledge and skills in problem solving situations depend on the learning context that must be a problem-based context as well (Adams et al., 1988; Perfetto, Bransford, & Frank, 1983). If we consider students' applications of self-directed learning strategies in problem solving situation we can infer that as students continually use their knowledge and self-directed strategies in a problem- based environment to solve the problems their self-learning skills which can be easily transferred to new problems. Different problems in a problem-based environment provide students variety of situations in applying their self-directed learning skills. The variety of cases in which students experience their knowledge and self-directed learning skills provide them flexibility in their application of knowledge and self-directed skills. That in turn facilitates of application of these strategies to the novel situations. Thus, continuous practice of self-directed strategies in a variety of problem solving context increases the transfer of the skills. Students learn and practice their self-directed learning skills and strategies in problem-solving situations and abstract the process in their mind and later, when they encounter novel problems they use previously learned strategies. Salomon and Perkins (1989) indicated that in the small groups students reflect on whole the process they went through in problem-based context and this reflective activities increase the chances the students will be able to apply their self-directed learning strategies in a range of situations. That's why the process of reflection in the problem-based is said to be an important element of self-directed learning (Salomon & Perkins, 1989).

<u>Social-Cognitive Theories</u>:

Social-Cognitive Perspective provides insight into characteristics of problem-based learning situation in development of self-directed strategies. Theories claim that there is interdependence between human and social environment in knowledge construction process and language has an important part in this process. Vygotsky claimed that the entire activities take place in the cultural environment appears in a child's development path twice, inter-psychologically and intra-psychologically. The inter-psychological means an exchange between an individual with others, and intra-psychological process directed by individual. Both social interaction and an individual have important roles in the knowledge construction process. It is believed that at the beginning in the knowledge construction process learners depend on others because of their limited experience, but as the time passes they become more responsible of their learning and participate in joint activity. In problem-based environment when students first meet the problem the tutor provides necessary scaffolding to them in solving the problem. However, as time passes students transform external activities that are called internalization.

According to Bandura (1977), behaviors and reasoning strategies of social cultural models affect the behaviors of children. In his study presenting the behavior of the model either electronically or live did not make any difference on students' influence of the social model. In addition to this prestigious, powerful, competent models have more powerful effect on children's behavior and much more readily imitated (Bandura et al., 1963). Children do not need to immediately

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practice the behavior of the model. In order to acquire the behavior of a model a student first needs to pay attention and determine specific features of the response of a model. After that he or she must retain that knowledge and form a mental representation of the behavior to carry out in the future. When practicing the behavior, students need to be reinforced so that chance to repeat the acquired behavior would be increased. Zimmerman believed that the social cognitive modeling is the first step of children's development of self-regulated behaviors. He claimed that development of self-regulatory skills contains four phases: observation, imitation, self-control, and self-regulation (Zimmerman, 1994).

Therefore, students in problem-based curriculum observe the tutor in the questioning process while discussing and searching the basic mechanism behind the problem. That is a scaffolding process, a teacher model the behaviors in small group and then students internalize and imitate the skills through which they gain self-control of their learning process and self-regulate their behaviors.

Advantages of Supporting Self-Directed Behaviors in Classroom

There are clear advantages of facilitating and supporting self-directed behaviors of elementary students. First of all, the amount of time of learning increases without using and sacrificing some extra teaching or instructional time. Since amount of time spent in learning activities directly affect achievement as parallel to the literature, increase in students' self-directed learning activities expected to increase their achievement.

Secondly, due to the existing condition of teaching process, teachers are thought to be the first degree responsible for students' fail or achievement. This understanding increases anxiety among teachers. However, giving students responsibility of their learning may help teachers to relax and students stop seeing teachers as an only source of knowledge and they may change their status from being passive to an active one. This change in teachers' role also shows its effect on shifting teachers' time from just conveying knowledge base to monitoring and responding to the needs of the students. Other side effects of shifting responsibility of learning process from teachers to students become apparent. Mentioned by Thomas (1993) studies of Borkowski, 1987; Harris & Ttrujillo, 1975; Palincsar & Brown, 1984; Sagotsky, Patterson & Lepper, 1978; Wang & Stiles, 1976 indicated that when elementary students take responsibility of their learning and show self-directed learning behaviors such as goal setting, self-control, and self-monitoring their on task behavior and achievement improves compared with uninstructed control students. Thomas (1993) also mentioned the studies of Corno & Rohrkemper, 1985, Covington & Beery, 1976; Kurtz & Borkowski, 1984; McClelland, 1978; Nicholas, 1983. These researchers have found that, students who take responsibility of their learning and show self-directed behaviors show changes in terms of increase in their personal efficacy, motivation to learn, and effort on learning tasks.

Third advantage of improving students' self-directed behavior is that of prepares them to meet demands of the future world. As in this cased future demands of secondary school, high school and real life requirements. For example, demands of elementary education to students very different than high

school students'. In one research tried to determine students' concerns about junior high school revealed 32 of them and being able to get work, having too much homework to do, the difficulty of school work, and the difficulty of homework were the first four (Mitman & Packer, 1983).

Educational conditions are differing greatly among countries and benefits students get from learning self-directed skills also differs. Number of students in a classroom is a one factor has to be considered when thinking about learning process. In Turkey, especially in big cities, number of students in one classroom can be between 45-55 students per-class and even 60. Therefore, educational methods that teachers use in classes differ both qualitatively and quantitatively. If you have 45 elementary students in your class it would be difficult to satisfy learning needs of each child and difficult to arrange instructional practices to meet needs of those children. Both numbers of students in a class and limited time span to achieve curricular practices are obstacles for the success of a learning process. A teacher in a that kind of a classroom does not have time even to think whether or not each child learn the material or seek for help if they don't understand and verbalize his or her needs so. As a result, in an educational environment like this we cannot say that each child is able to get necessary help when needed, comprehend necessary knowledge base, to get ready for future educational experiences and not able to reach his or her potential.

Teaching self-directed practices to those students may be an alternative to classical educational practices. In a crowded class if you teach students to determine their learning needs, to find and use human and material resources, to

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evaluate those resources, to monitor and control their learning through an application of problem-based learning environment you not only achieve maximum learning outcome in terms of achievement, but also help students reach their maximum individual potential. Students may direct themselves to personally relevant goals; learn their own pace, construct personally relevant knowledge, allocate necessary time for learning material, which in turn increase in their motivation to learn as well. Teachers also become free form a big burden, satisfying all individual learning needs and creating an instructional design for each child. As indicated in the literature, students may easily adapt for future education conditions and reach the ultimate aim of education, become lifelong learners.

Some researchers have claimed that elementary students are developmentally lack the ability to apply and use self-directed learning skills and not until mid to late adolescence that children show spontaneously the kind of self-monitoring and self-management behaviors (Brown, 1978). Gettinger (1985) found that fourth and fifth graders were unable to allocate necessary and sufficient time to master the subject. On the contrary, studies show evidence that students at the age of five show the meta-cognitive learning behaviors and learn the questioning method, which are important factors to be a self-directed learners, if appropriate educational and instructional method is applied. Thus, some people believe that students' inability to show self-directed learning behavior is because of the demands of current education system, the instructional aids (compensations), supports, opportunity and the goal structure (Thomas, Strage, & Curley, 1988). The classroom demands of elementary education are different than

undergraduate education. In elementary education instructional practices are not demand students to comprehend the reading assignments and readings are free of ideas (Thomas, Strage & Curley, 1988; Thomas, 1993). Criteria of success and failure are also different than secondary school criteria. In addition to this some type of instructional practices prevent students in application of self-directed behaviors. Fill-in-the-blank type of questions, outlining central events and summarizing main ideas, handouts form barriers against students' selection, comprehension, integration, extension of knowledge, reviewing material, trying to get the main idea and augmentation during self-study (Thomas, 1993). Students engage in non-strategic activities like encoding and rereading the material and trying to memorize the facts (Thomas, 1993). Teachers also use same wordings in those handouts most of the time in the tests. For this reason, it is believed by some researchers that an elementary classroom demands affect development of self-directed behaviors negatively. It is also a known fact that examinations are basic source of anxiety for elementary and secondary students. They have pre-examination high, post examination low anxiety. On the other hand the pattern of anxiety in problem-based learning is different. Students try to answer " do I know enough?" question and they don't study the subject only to pass the examination. Therefore, anxiety levels in problem-based learning are high and constant among its students (Ferrier, 1990).

Positive research findings about teaching self-directed skills to elementary and middle school students indicate the importance role of in today's elementary and middle grade students. Therefore, curricular and instructional practices should

be changed and modified so that elementary students develop self-directed behaviors.

Conclusions

The purpose of education is to fortify individuals with some skills that help them manage their life in the future. The real life situations require them not only have knowledge but also create new knowledge in order to deal new situations in an effective and efficient manner. When they encounter problems in their life they need to formulate specific questions about new situation so that they can get specific information, search for the validity and applicability of their existing knowledge for the new situation, find and effectively use resources in relation to the new case. All of the required and needed skills and qualities are called as self-directed skills or meta-cognitive learning abilities (Brown, 1978). As Saljo (1979) indicated that " when people became aware of their own learning in different respects, they will be better equipped to deal with various sorts of learning difficulties such as problems of the kinds encountered in everyday life, or at least, in everyday studying". Problem-based learning environment is believed to foster self-directed behaviors of students. The problem-based learning literature shows positive findings about effects of problem-based learning on development of students' self-directed learning behaviors. The learning process in the problem-based learning begins with the problem. First students are given the problem. Their job is to understand this problem by explaining principles, process and mechanisms behind it (Schmidt, 1983). They first approach to solve the problem with their existing knowledge, opinions and ideas and discuss the possible explanations of it in the small group. They discussion help them realize what they

know and what they need to know related with the given problem. Schmidt claimed that while students are working with the problems they could easily determine proficiency of their knowledge to solve the problem. This will give them direction for their future study. Students develop their future learning objectives and search for the literature for those objectives. This is the point where self-directed behaviors of students begin.

Specific characteristics of problem-based learning believed foster and facilitate the development of self-directed behaviors of the students. These are namely the student-centered nature of problem-based learning, having students attempt to identify and solve a problem with their existing knowledge, identifying knowledge deficits and generating appropriate learning issues, the independent research effort, critiquing the resources used for research, applying the new knowledge to the problem, and collaborative reflection on self-directed learning (Evenson & Hmelo, p.229). Dolmans, Schmidt and Gijselaers (1995), Walton & Matthews (1989); Blumberg et al. (1990) and Blumberg and Michael (1992) provided evidence for effects of determining learning issues on students' self-directed learning behavior. The development of learning issues is found to be related with development of self-directed behaviors of medical students even the learning objectives of the problem-based learning partially determined by the teacher.

Rumelhart & Ortony, (1977), Schmidt et al. (1989), Mayer and Greeno (1972) and Mayer (1982) indicated that problem discussion in small group helps students activate their prior knowledge and helps them to realize their knowledge

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deficits. Understanding their knowledge limits students generate further learning questions. The learning questions they produce are much more meaningful in terms if their learning needs than teacher produced ones. Activation of prior knowledge determines what can students do with their knowledge and what can they do with new knowledge.

Students search the literature to obtain necessary knowledge for their specific learning questions. They must do the literature search an effective and efficient manner. Therefore problem-based students are expected to be better library users. Rankin, (1992) Blumerg & Michael, (1992), Marshall, Fitzgerald, et al. (1993), and Blumberg and Sparks (1999) found that problem-based students are better library users, use library more often, apply different resources than traditional curriculum students. Rankin (1999) also found that problem-based students are better information consumers and better source evaluators that traditional counterparts. Schmidt, Van Der Arend, Moust, Kokx, & Boon, (1993), Saarinen-Rahikka and Norman (1995), Blumberg and Michael, (1992), Gijselaers and Schmidt (1992) also indicated that students engage in problem-based curriculum spent more time for non-scheduled activities. In problem discussion students generate hypothesis related with the problem provide multiple perspectives for each student that in turn affect their self-learning behavior.

On the other hand, Dolmans et al. (1992) found that the generation of learning issues affects self-directed behaviors to some extent. It is important to determine other curricular elements of problem-based environment because those elements provide alternative ways to support students' self-directed behaviors. Dolmans and Schmidt (1994) indicated that discussions in the tutorial group,

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content to be tested, lectures, tutor, and reference literature also impact on students' self-directed behaviors. As students progress through of problem-based curriculum effects of all elements on students' self-directed behaviors decreased except small group discussions. The quality of the problem and tutor other factors that affect small group discussions. The problem itself must challenge students and increase their curiosity. It must lead them to further learning. Therefore, the knowledge base of students and difficulty level of the problem must be thought carefully. Tutor behaviors and qualifications are another factor affecting small group performance. A tutor needs to be subject matter expertise, interested in his or her students' lives that is he or she must be socially congruent and able to "express himself or herself at the students' level of knowledge; using language of students, using concepts like students use to explain things" which is cognitive congruence, so that students easily get the meaning of the explanation. Blumberg and Michael (1992) believed the importance of consistency among elements of problem-based curriculum in order to facilitate and support self-directed behaviors of students efficiently is very important.

Contrary to vast amount of self-directed literature among undergraduate medical education, literature of self-directed learning behaviors among elementary students is limited. It was claimed that young students are not able to show self-directed behaviors because they have developmentally immature for this process. Self-directed behaviors are believed to be a factor of an age of a student; that is, as students get older, their self-directed behaviors increase with proper instruction and guidance. Problem-based curriculum combined with project-based approach and applied to elementary students. Findings reveal that fifth graders benefit

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problem-project based learning. They also developed and used self-directed

behaviors efficiently in comparison to traditional curriculum students. Unlike to

common beliefs Alexander et al. (1995) found that developmentally third grade

students showed self-regulated behaviors in a proficient manner. Teaching meta-

cognitive method to elementary kindergarten students found promoted their self-

directed learning behaviors and transfer of learning. It was also found that at the

age of four kindergarten students were aware others self-regulated behaviors.

Even though young children are capable of performing self-directed related

behaviors, they need to experience and opportunities to in order to learn self-

directed behaviors (Brown & Campione, 1977).

Achievement among elementary and middle grade students was found as a

factor of their self-directedness. Changing demands of the world also force

elementary students to learn and perform self-directed behaviors as well.

Therefore, teaching and instructional practices should be arranged in a new form

in order to facilitate and support self-directed learning behaviors among

elementary students. In order to prepare students for lifelong learning, they need

to have experience in self-directed learning while in school (Bereiter &

Scardamalia, 1989). Elementary education practices must be improved in a

different way than as it is now.

1)   Studies support the idea that unlike undergraduate students,

        elementary students need more teacher direction and control in

        development of self-directed behaviors.

2)   Students must be included in the decision making process about

        their learning. By giving them a chance does not exclude

        teachers in the decision process. Sharing the responsibility of the

        class gives them responsibility of their learning. They take

        control of it. It is proposed that students who do not have part,

        ownership and value in the learning process have no concern to

        worry about.

3)   Teachers should encourage students to think and talk about what

        they are doing to themselves and to others. It is believed that

        verbal thought process very important in development of self-

        directed behaviors. It was found that less self-directed children

        are less likely to apply this verbal thought process while doing a

        task. Therefore, teachers must carefully monitor students,

        arrange environment in a way that self-directed behaviors of

        children supported through interaction. The interaction must be

        two folded teacher-student and student-student.

4)   The knowledge level of students and difficulty level of tasks

        should be closely controlled because too easy and too difficult

        tasks do not provide self-directed learning experiences for them.

        This indicates that the important thing is providing right settings

        and tasks for children and according to their skill level and

monitoring continuously so that necessary adjustments and changes can be made.

5) Instructional goals must be clear on students' mind and they are clearly told the expectations from in terms of both course and performance (Thomas, 1993).

6) The qualities of practice material through which students experience their self-directed behaviors are found important. For example, using novel and open ended problems through which students perform their skills and decontextualize the central principles of a discipline, interactive problem-solving opportunities in which students get in touch with their peers (Thomas, 1993).

7) Students need to be given performance feedback continuously. Feedback not only helps them improve their behaviors but also increase possibility of showing same kinds of behaviors.

8) Providing opportunities to students to model the behaviors of others by arranging learning setting such as peer tutoring, cooperative learning, and peer tutoring help elementary students to develop self-directed behaviors and show them in a different occasions (Thomas, 1993).

These suggested advices for elementary students' also supported by problem-project based research. According to Barron et al. (1998) a learning design must provide learning-appropriate goals for better connection of knowledge and activity, scaffold students in solving problems, formative self-assessment and revision, social environment that is important for development of self-agency. Slavin (1987) put it another way; "In order for children to truly become self-regulated learners, the classroom should include teacher directed, small group and seatwork instructional styles to provide direct instruction, independent practice, and the opportunity to practice meta-cognitive skills in social context".

The whole problem-based learning may not be suitable for crowded classes due to difficulties in its application, but by designing it most appropriate for high number of students condition can facilitate self-directed behaviors of those students. First, a teacher control is necessary and important if you have high number of students in your class. By slowly and in an controlled manner engaging students in classroom decision process, making expectations clear at the beginning of the process, arranging cooperative learning and study groups, encouraging verbal thought process among the group members, increasing the quality of work by selecting it carefully taken students' knowledge level in consideration can apply in the crowded classes. Teachers may not provide feedback individual bases in verbal form, but they may give it through written form on students' works. I think most important and easy way for teachers to support self-directed behaviors of students, they must show positive attitude toward self-directed behaviors and should be a self-directed learner himself or herself. The development of self-

directed behaviors of students in crowded classes may be a huge trouble at the beginning and classic teaching forms seem much more easy. However, as the theory suggests as students progress through the problem-based curriculum they need less help.

However, there are some concerns in application of problem-based curriculum. First of all it requires more staff time compared with traditional curriculum. Unlike a lecture format a teacher must be actively involve in class and monitor all students. The other concern is evaluation of students in problem-based learning. The evaluation of students in terms of problem-based learning requires development of different kind of evaluation method. The application of problem-based learning and facilitating self-directed behaviors are very strange applications either for teachers or students. It is very difficult to change a learner from passive state to an active state and instruction practices from a lecture format to an active one and takes time. But, if you try to accomplish that chance at an early age and support we will get better results in terms of both from students and educational aspects. The importance of self-directed learning skill is become prevalent in crowded classroom conditions. In that type of classrooms teachers mostly don't have time to satisfied individual needs of students, monitor their activities, and importantly help them when students are having trouble in comprehending and understanding a topic. Therefore, teaching students self-directed learning skills, facilitating and supporting their self-directed behaviors demands change in instruction and curriculum. Most importantly teachers have to be self-directed themselves.

In conclusion, students in PBL curriculum shows self-directed behaviors: they are better knowledge consumers, deep level knowledge processors, aware of their knowledge status, know what to do, how to do, able to define what to learn. All of these qualifications are extensions of PBL curriculum, because PBL curriculum is student centered, have students identify and solve the problem with their existing knowledge, help them define their knowledge gaps and formulate learning issues, let them show independent research effort, help them evaluate resources, apply new knowledge to new situations and help them be a good collaborators (D. Evenson and Cindy E. Hmelo, 2000, p.229). These changes in learners' behavior are crucial for their future life. Therefore, unlike today's education system, schooling should aim preparing life-long self-directed learners.

Chinese proverb clearly expresses the importance of improving students' self-directed behaviors. " Give me a fish and I eat today. Teach me to fish and I will eat for a lifetime". Schooling practices have to teach students how to fish through their education experiences.

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