

CHAPTER 7: PROJECT BASED LEARNING

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INTRODUCTION

In the simplest sense, learning can be defined as permanent behavioral change as a result of an individual's interaction with his/her environment at a certain level¹. Learning is very important in terms of an individual's life. The power that activates students to learn, in other words, motivation to learn is very important in school learnings². Teachers have important roles and responsibilities at school for learning, which is an important dimension of teaching process to be effective for students. The one who is active about teaching services at school and in class is the teacher. So, the quality of teaching is very important. While ensuring the quality of this teaching, the signs or directions presented to students, students' active participation in learning process directly or indirectly, reinforcement presented to students related to learning, the function of the system of feedback and correction are each very important³. While talking about learning, some of the criteria reached by learning theorists should be kept in mind. Some of the criteria that should be used to evaluate any learning-teaching method are remembering what has been learnt, transferring what has been learnt to new situations or to problem solving, the level of cognitive processes included in learning and the positive attitude and feelings about learning⁴.

It is possible to reach effective results in learning by means of considering the basic concepts and elements about learning. Studies about learning as a comprehensive concept have always been carried out. Permanent learning is aimed in classed in the light of what is known and done. There have also been changes about teaching methods and approaches within the framework of studies to dynamize learning process. One of the situations aimed with the new learning approaches and methods is to ensure students to use what they have learnt more effectively.

The last innovations and developments have also affected the activities related to learning and teaching. Structuralist learning approach, which has been effective on educational systems all over the world, affects the classed in that sense. Structuralist theory emphasizes the necessity in education for the individuals to think and understand more, to be responsible of their own learning, and to learn how to control their behaviours⁵. At this point, the points which are just some of the features of structuralist class environment⁶ and which are stated below are quite important:

- Students' wishes, needs and questions about various subjects have a wide coverage in teaching process.
- The activities related to educational programme are mostly based on primary resources.
- Students are accepted as individuals who are responsible of their own learning, who make sense of the knowledge they get from around in their mind and for this reason who are active in learning.
- Teachers interact with students mutually as a learner in the process of learning and they arrange learning environment.
- Students generally carry out-group work.

All these features also affect teaching approaches. Especially when new teaching approaches such as problem-based learning, cooperative learning and other new approaches are examined; the points stated above are realized to be leading features. One of these new approaches is Project-Based Learning.

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WHAT IS A PROJECT?

The concept of project includes multi-dimensional activities composed of small and big projects⁷. The concept of project is sometimes used in the meaning of homework. When the duration dedicated to exercise, homework and project is studied, it is clear that an exercise needs 0-2 hours; homework needs 2-12 hours while a project needs 12-60 hours⁸. At this point, it is useful to answer the question of "What is a project?"

Project is a task or a series of tasks that have to be completed by students individually or in groups⁹.

Project is a whole of studies carried out by the students individually or in groups in order to solve a problem related to ensuring a concept or skill to be acquired¹⁰.

Project in terms of education: a deep research, implementation and sharing of a subject that is worth to learn more about¹¹ (Katz, 1994; cited: Doğanay and Tok, 2007, p. 234).

Projects are complex tasks; they are based on challenging questions or problems; students carry out activities such as design, problem solving, decision making or investigation; students are given the opportunity to study for a long time and realistic products are produced at the end¹².

In project tasks, students are usually presented an individual subject to do a deep research. In this type of study, students study independently to do, write and present their research. A project task can also require a group of students to study on the same problem but on the different dimensions of the problem¹³. Moreover, projects are expected to be long-term, to require team work among students and to result in a product, and these results prepare students to deepen their level of understanding, to develop new skills, and thus to develop in academic means and to use them in their future business lives¹⁴.

Projects are mostly open-ended. A study of project or homework is a creative process at the same time. This process requires these steps in general¹⁵:

- (1) *Deciding on the goal:* At this point, an answer is sought for the question of "What are expected to be achieved with this project?"
- (2) *Reviewing the resources:* At this point, these questions are tried to be answered: Is there enough time? What is the appropriate place for a special material or project work? Is library work necessary?
- (3) *Reviewing the necessary skills:* How much do students know how to benefit from a library for this project? Are they skilled enough to carry out the tasks?
- (4) *Designing the activities:* This is the step where one should be sure of the fact that the activities will meet the goals.

By means of project works, students develop skills such as examining a problem or a matter, arranging result, putting the data in a graphic form¹⁶. On the other hand, a project can be in two different forms and both forms can be used at schools: (1) classical project which is effective in learning scientific study and (2) creative project which is effective in producing new and original ideas. Both types of projects are important in the process of learning and motivate students for new learnings¹⁷.

In other words, projects can be accepted as an opportunity for individual learnings¹⁸. In the course of teaching, these opportunities presented to students can be developed by means of ensuring students to believe in themselves about achieving the goal and to see where and how they will use what they have learnt.

Project should be designed so that a connection can be established between activities and basic conceptual knowledge that is aimed to be developed. At this point, a problem that is not well defined has quite an important function.

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Some of the features of a project are as below:

- Projects should ensure students to join a constructivist research. Students should construct knowledge within the scope of central activities of the project.
- Students to a great extent should direct projects. In these projects, students choose, they have got a deadline for studying and they take responsibility. Traditional projects do not have these features.
- Projects are realistic. Projects have features that ensure originality. These features include subject, tasks, the role of students, the context in which the project will be carried out, the people with whom students will be in the project, the products, the target audience of the products that will come out at the end of the project or criteria which will be used to evaluate products (performances)²⁰.

In brief, projects are very important for teachers when they are used effectively and they have really got a strong impact when they are used correctly²¹.

Within the framework of project based learning (PBL), project is the basic teaching strategy; students learn the basic concepts of the related area. When the projects from which students learn are out of programme or are "enriched projects", this technique is not PBL²². PBL projects focus on questions and problems that ensure students to come across central concepts and principles of an area. PBL is one of the teaching approaches that can be used to provide students with such opportunities.

WHAT IS PROJECT BASED LEARNING (PBL)?

One of the oldest programming approaches is known to be "project work"²³. It is clear that Project Based Learning, which has been accepted to be one of the modern teaching approaches, is also a subject studied by John Dewey at the beginning of 20th century. On the other hand, it can be said that PBL is a synthesis of project implementations of the past²⁴.

In terms of philosophical fundamentals of Project Based Learning, teaching trends of pragmatism and progressivism have impact on them. As is known, while pragmatism centers the learner, defines the teacher as a guide in this process, centers the interests and skills of learner as the core of the programme, progressivism emphasizes that education is not a period of preparation for the life, but it is the life itself²⁵. Moreover, constructivist approach is also influential in PBL approach.

PBL displays the features of a constructivist approach as a student-centered approach²⁶. However, PBL does not have a common model or theory. Because of this reason, a lot of various PBL researches have been carried out. This causes difficulty in studying the researches that have been carried out. For example, it is difficult to determine what is a PBL. In other words, it is difficult to differentiate PBL and "a real project." On the other hand, there are some PBL implementations although they are not called PBL. These implementations are called "purposeful learning" or "problem-based learning"²⁷.

Different educators emphasizing the similar themes define project Based Learning Approach. For example, Project Based Learning (PBL) can be defined as "a model that organized learning depending on projects"²⁸.

Another definition is that PBL is a learning approach which puts forth that learners try to solve a problem they can come across in real life by means of establishing relations between different disciplines and handling the problem in the framework of a scenario in a class environment²⁹.

PBL can also be described as an approach that envisages the students to solve a problem depending on concepts and principles they have learnt in different disciplines, to project a research individually or in groups in order to reveal a product and to carry out studies using scientific methods³⁰. PBL comprises real situations where the focus is an original question or problem, and where there is a possibility to implement solutions. Five criteria that define project based learning are as below³¹:

1. PBL projects are not out of the programme, but they are in the center of it.

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2. Students of PBL projects focus on questions or problems in order to come across basic concepts and principles of a discipline.
3. Projects ensure students to carry out a structuralist study.
4. The students carry out projects.
5. Projects are realistic.

The three concepts that constitute the core elements of Project Based Learning Approach emphasize that³²: (1) PROJECT: project is a design, (2) BASED: project is a process, (3) LEARNING: the approach is student-centered. Learners join a research by means of asking important and meaningful questions according to PBL approach. In the course of this research, students ask questions, guess, design research, collect and analyze data, use technology, form a product and share their ideas³³. Some of the features of project based learning are original content, original evaluation, and teachers as facilitating but not directing the process, clear educational goals, learning based on cooperation, using deep thinking and adults' skills³⁴.

In the process of project-based learning (PBL), students understand a subject matter better since they learn through doing and experiencing³⁵. Indeed, it is not new to have students carry out project works. On the contrary, carrying out project works at school and developing interdisciplinary subjects have a long past³⁶.

PBL is an interdisciplinary method. Subject matters of a project can be studied independently while they can also be studied in relation to a lesson. However, the theme of the project is searched by means of establishing a relation with other disciplines no matter how it is planned³⁷. By means of PBL, students also learn how to establish a relation between lessons such as maths, social sciences, and science while trying to find a solution for the problem on which they are carrying out a study³⁸. During this process, students establish inter-disciplinary relations themselves by means of using information they have learnt and reached before³⁹.

In the course of project based learning, students build knowledge and make new decisions by using their research and background information. Thus, **their motivation increases** in terms of studying and learning, other skills such as strategic thinking and guessing also develop⁴⁰. Students learn more voluntarily since the project subjects address real life in PBL⁴¹. Students learn how to **reach different resources**, how to benefit from different resources in the course of PBL. Students reach written, visual, electronic, etc. resources and try to find a solution related to the subjects or problems on which they study within the framework of a project and thus their **skill to gather data and use the data in line with the problem** develops.

Implementing PBL in class also requires some amendments on **the organization of the class**. For example, if a learning environment has to be created by using this approach, students should be arranged to sit in groups in class. This kind of arrangement will facilitate students' discussing among themselves, sharing information and producing solution offers by thinking together.

On the other hand, PBL can be carried out individually, as a whole class or as team works. Thus, when PBL is designed as an individual task, it will maintain the development of independent working skills and when PBL is designed as team works, it will maintain the development of students' skill to work in groups as a team⁴².

In brief, some of the leading features of Project Based Learning can be summarized as below⁴³:

- *Planning and implementing PBL is not so easy. Especially, it can be difficult to plan, manage or evaluate PBL and it is necessary to implement PBL in a supportive context in order to diminish these difficulties.*
- In PBL, there are some cases where students have difficulty in benefiting from situations, which they direct themselves especially when complex projects are in question. The leading difficulties faced by students are starting and directing the research, time management and using technology

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effectively. It is necessary to have students gain a lot of values such as helping them to learn how to learn for PBL to be effective as a teaching method.

- *Students and teachers believe that PBL is beneficial and effective as a teaching method. According to direct and indirect findings gained from students and teachers, PBL is a more popular method than traditional methods.*
- *According to the results of some PBL researches, PBL has got some beneficial but unintentional results. Some of these are like that: increasing the communication between students and teachers, increasing the rate of students' attendance to school and taking responsibility and improving the attitudes towards learning.*
- *PBL is also either a bit better or equal to teaching methods about achieving acquisition in general academic success.*
- According to the findings reached with the studies that do not include comparison group, PBL is an effective method to teach some complex processes such as problem solving, planning and decision making to the students.
- There are some evidences, which prove that PBL is more valuable than other traditional methods about increasing the quality of learning.

STEPS OF PROJECT BASED LEARNING

One of the most important elements of project-based learning is **projects** around which students will carry out their studies. It is not easy to determine the scope of the project. Because of this reason, study plan should be prepared clearly with the guidance of the teacher and this plan should be followed regularly⁴⁴. At this point, steps to prepare a project should be considered. The steps stated below should be kept in mind in the process of running individual or group projects⁴⁵:

- 1. Determining the theme and sub-themes, and making groups:** Students can offer questions for a framework project after searching various resources. Questions are classified by means of creating interesting problems. Students contribute to the formation of project groups.
- 2. Groups prepare project plans:** The members of the group prepare a project plan all together. They seek answers for the questions such as where and how they will go, what they will learn. They choose resources, define roles and distribute plans by means of planning their studies. Thus, they do division of labour among themselves.
- 3. Implementing the project:** The members of the group analyze the data and information in an organized way. They seek answers for the questions, collect data, organize information, interview with the resource people, combine and summarize their findings.
- 4. Planning the presentation:** Students decide on the basic points of the presentation. They ensure preparation of materials necessary for presentation after planning what kind of a presentation will be made.
- 5. Making a presentation:** Presentations are made in class and in other previously determined places (in other classes, at other schools, etc.) and a feedback is given to the class.
- 6. Evaluation:** Students share the feedback about the project and they do the necessary comments with the teacher and other students.

These steps can also be listed similarly as follow: (1) Choosing the subject / problem (2) Collecting preliminary information (3) Following a scientific way (4) Preparing a study plan (5) Collecting data (6) Interpreting the data (7) Deducing results and suggestions (8) Writing a report (9) Preparing a board (10) Making an example presentation⁴⁶.

The main steps of PBL learning can be listed differently as below⁴⁷ (002): (1) determining the goals (2) determining and defining the job to be done or the subject to be handled (3) forming teams (4) determining the features of the final report and the form of presentation (5) making a study calendar (6) determining check points (7) determining evaluation criteria and sufficiency levels (8) collecting information (9) organizing and reporting the information (10) presenting the project. Moreover, the implementation steps of project based learning approach can be handled in three steps. The steps and their features are given as a graph below⁴⁸.

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1. STEP	2. STEP	3. STEP
<p>INITIAL PHASE</p> <ul style="list-style-type: none"> • Teachers and students study together to choose and organize research subject. • The teacher or the students can determine the subject. While choosing the subject, some criteria such as being related to students' daily lives and being rich enough to do research should be kept in mind. • The teacher brainstorms with students and forms a mind map of sub-themes related to the subject. The questions to be used throughout the research are determined. 	<p>FIELD SURVEY</p> <ul style="list-style-type: none"> • Generally, field trips and direct research are carried out to search the previously determined project subject. • Mostly students are active. • Students do research, note their observations, form models and record the results. 	<p>SUMMARIZING AND CONCLUDING</p> <ul style="list-style-type: none"> • Students prepare and present a report related to their findings. • At the phase of presenting the report, all the studies carried out throughout the project are shared and evaluated with the class.

If the content of teaching is in line with the expectations and goals of the student, the active participation of students and thus the level of learning increases⁴⁹.

THE BENEFITS OF PROJECT BASED LEARNING

Project based learning is said to have a lot of benefits in terms of learning. For example, four benefits of PBL for students can be explained as below⁵⁰:

- (1) Learners combine the content and process, and thus they develop a situation of deep understanding,
- (2) Students learn to study together in order to solve problems. This process of studying together requires to share ideas in order to find answers for the questions,
- (3) This approach improves responsibility and team work,
- (4) Needs of many different students are met since students carry out different tasks according to this approach.

Some other benefits of project based learning for students can be listed as below:

<p>PBL;</p> <ul style="list-style-type: none"> • ensures deep understanding of the subject and concepts, • ensures students to get interested in the subjects of the field and thus to learn more easily, • ensures students to improve their skills to work all together, • develops the permanency of knowledge and skills and the skill to use them in new situations, • develops the advanced cognitive skills of students such as data analysis, problem solving, etc. and ensures the increase of students' responsibility towards their physical-social environment, • increases students' motivations and ensures the creation of new interest areas, • develops students' skills to make a decision, • ensures the development of students' skill of self-management, • helps students to form and improve critical thinking skills, • helps students to participate in the process of project actively and to shape their ideas, • helps students to reveal their interests and skills,

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- helps students to gain life skills (planning, etc.)
- helps students to use the information and skill they have gained by means of transferring to real life,
- helps students to learn how to understand the relationship between different disciplines and benefit from this in the process of problem solving,
- helps students to combine application and theory,
- develops students' study skills,
- helps students to learn how to work as a team and take different responsibilities,
- ensures the development of students' advanced thinking skills,
- ensures the decrease in negative behaviours in and out of class, and thus helps teachers about class-management,
- helps students to improve their research skills,
- helps students to learn how to evaluate their own and each other's studies,
- offers multiple ways in order for the students to reflect their information and to join,
- helps students to learn and develop the problem solving techniques and the steps of scientific method.

Resources: (51,52,53,54,55,56).

This list shows that project based learning ensures multi-dimensional benefits for students. It shows that project based learning has benefits in terms of different dimensions when each of the clauses are examined.

It is possible to explain these benefits of PBL as various skills that develop in students⁵⁷:

- *Vital skills:* managing a meeting, preparing a budget, making a plan, etc.
- *The skill of using technology:* using computer, television, radio, video, etc.
- *The skills of cognitive process:* Decision making, critical thinking, etc.
- *Self-control skills:* setting goals, organizing processes, time management.
- *Attitudes:* interest in and curiosity about learning, etc.
- *Tendencies:* self-control, the feeling of success.

These skills are also important in that they are some features, which are important all throughout life.

THE LIMITS OF PROJECT BASED LEARNING

As project based learning is an approach that focuses on deep research, this approach of research may also require doing some changes in class environment. Since different students will do researches on different subjects, the role of the teacher will also change just like students' roles change. This process should develop slowly in class, because the process of deep research will require more time to understand a subject. In this case, it is very important to design the projects so as to realize the goals of the programme. Another important point is that since students will join the study in groups or as a team according to PBL, it will provide great advantage if the students have got the habit and skills to carry out group work beforehand⁵⁸.

As is clear, project based learning has some limits as well as benefits. The format of team work can be difficult for students who are used to individual studying more. On the other hand, it may be difficult to determine how much the students contribute to the study in the course of the project unless an effective evaluation is carried out. Moreover, PBL can be accepted as a time-consuming approach.

A limit with a few dimensions may exist in teaching with PBL. The content knowledge of the teacher, students' inexperience about this approach and so their choice of more traditional approaches, their preference of less demanding learning environments, time concerns can be included in these limits⁵⁹.

Some of the situations that can be accepted as the limits of project based learning include:

- It may take a long time for students to complete the project.
- If the project is carried out of teacher's guidance, some important problems may arise.
- Some students may have difficulty in finding a project subject.
- It may increase teacher's workload and responsibility.

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- It may be time-consuming to control students' studies.
- It requires necessary materials for the study to be ready.
- Time dedicated to learning may be longer.
- If the boundaries of the study cannot be defined well, divagation and breaking down can be inevitable (⁶⁰, ⁶¹, ⁶²).

In brief, if an effective plan is not made, students can have some troubles. In this case, the limits of PBL instead of its benefit come into prominence.

EVALUATION IN THE PROCESS OF PROJECT BASED LEARNING

The final phase of learning process is evaluation. One of the indispensable elements of project based learning is also evaluation. Evaluation is carried out for different purposes. One of purposes of evaluation is to help learners in the process of learning. In the process of project work, students are evaluated according to whom they study, how they carry on their studies and how they finalize their studies. Since the process of project-based learning is different from that of traditional learning, the roles of the learners have changed as mentioned before. Students are not passive any more they are active now. Students also keep their active roles in the process of evaluation. Students can join the evaluation individually or in groups. Another advantage of the learners in project-based learning is that they can get an instant comment, contribution, feedback or an evaluation related to an amendment⁶³.

Within the framework of project based learning, students can also be evaluated through different techniques such as evaluation based on sample situation, individual and peer evaluation, performance evaluation and evaluation of developments which are also used in traditional methods. According to the related body of literature, traditional evaluation techniques are less appropriate techniques in order to evaluate concepts and skills gained through project based learning approach⁶⁴.

In the course of PBL, evaluation develops in a different manner. In other words, the dimension of evaluation within project based learning approach has got a different structure when compared to traditional teaching approach. Evaluation is effective throughout all the steps from the beginning to the end of the process in PBL. In this approach, it is emphasized that evaluating students' level of success at the end of learning process is not sufficient, so it is necessary to evaluate all throughout the process from the beginning to the end. In project based learning, a lot of techniques can be made use of such as written homeworks, observation, presentation, and discussion.

When a teacher uses project based learning techniques, she/he can make use of the criteria stated below in the process of evaluation⁶⁵:

- Defining the project well in a written format and giving the necessary details for this
- Ensuring the evaluation to be transparent and complying with the criteria set at the beginning
- Ensuring the goals of the project to be clear and funny
- Students' sufficiency for the tasks defined in the project
- Sufficiency of resources
- Ensuring students' motivation of students for the job in the course of the development of the project
- Ensuring all students to complete the project successfully
- Commenting on the good and bad features of the project in the course of evaluation
- Checking what students have learnt from the project

In brief, evaluation is very important PBL. PBL implementations should certainly be evaluated. Does it make any difference on students' attitudes and behaviours about learning to have learning experiences based on this approach? Do the critical thinking skills of students develop? Such questions should be answered through studies⁶⁶.

THE ROLE OF THE TEACHER IN PROJECT BASED LEARNING

Teachers have important roles in project studies. Some problems may arise especially when the job of designing the project is merely carried out by the student. Students can misinterpret and misunderstand the given task, or they may fail because of following a wrong path. In other words, students may define the task in a completely different manner from what the teacher expects. Students' long hours of studying may result in failure. Although it can be defined as a mistake on a technical level, none of the students would like to be unsuccessful after long hours of studying. This situation may also create a negative atmosphere about motivation towards learning⁶⁷. In this sense, the teacher should be a good motivator throughout the project process, which is already one of the expected roles of the teacher⁶⁸.

The teacher has got a lot of roles in learning process. The teacher can make the scope of teaching suitable for children's goals by means of various ways. Thus, she/he can ensure their effective and meaningful participation⁶⁹. According to PBL, the teacher does not transfer information directly, she/he just guides students and helps students to structure knowledge⁷⁰. The role of the teacher has changed according to PBL. The teacher is no more a person who just lectures or is interested in teaching but also a person who supplies resources, shapes learning atmosphere, acts a guide⁷¹. Some of the problems faced by the teacher while implementing PBL can be classified under five dimensions⁷²:

Time:

It may take longer to implement a deepening teaching-learning approach such as PBL.

Class Management:

The teacher should establish a balance between students' need to study on their own and the need to keep the order in order to help students to study beamily.

Supporting learning:

Students should not be given too much independence or too little feedback; they should be supported when and where necessary.

Benefiting from technology:

Teachers have difficulty in using technology especially as a cognitive means.

Evaluation:

Teachers have difficulty in designing types of evaluation through which students can display what they understand from their studies in PBL implementations.

On the other hand, the advantages of PBL for the teacher can be summarized under three headings⁷³:

- (1) Teachers may find such kinds of studies entertaining and interesting, as teaching will be different every time because of the new projects they find.
- (2) The teacher gains new ideas continuously in PBL.
- (3) The problems about class management and discipline will diminish when students are involved in teaching environment.

Briefly, students carry out the projects in PBL implementations and the projects are long-term; it may take one term or two terms. In the process, the teachers has got a role who facilitates the process of learning or guides; namely, students take on the role of searching for knowledge instead of receiving knowledge directly⁷⁴.

Another role of teachers in PBL is to prepare a document, which tells students what to do for the project. Such a document to be prepared for each study can be distributed to students; thus, they may have a written guide about what to do. In such a document:

1. The goals and aims of the project should be defined clearly.
2. The tasks should be emphasized clearly.
3. There should be a draft for the criteria to be considered at the end of the project.
4. The role of the participants and resources should be specified.

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5. Timing information (the deadline for the project, the implementations to be done when the project is delivered in time, etc.) for the project should be set clearly⁷⁵.

As a result, if the teachers have got a strong motivation coming from their experiences, PBL can ensure the expected benefits for students and thus PBL can enrich their experiences more and more⁷⁶. Teachers take action for the projects based on certain principles in the course of design. These principles are as below⁷⁷:

1. *Defining the problem:* PBL has a meaningful problem as its basis. Projects start with an original subject or an important concept. Because of this reason, the problem or matter should be defined well at the beginning.
2. *Designing important questions:* A teacher runs the project on a purpose in PBL. The teacher defined what he/she expects from the students at the end of the project.
3. *Structuring the process of evaluation:* Students produce a result in PBL. The products of students are evaluated according to the criteria set at the beginning of the project.
4. *Retroactive plan:* At the end of PBL, enlarged learning experiences based on not only the end product but also on the process are gained. The teacher should be the one who directs his/her students throughout the project at this point.
5. *Being involved and studying:* The teacher should give importance to students' wishes and choices and should arrange timing information.
6. *Setting the teams:* It is very important to direct the teams for a better performance in order to ensure a successful project.
7. *Thinking of the end of the project:* The process of PBL is an indirect process of problem solving and it may differentiate. In this process, a good teacher knows how to manage the flow of study through projects and prepares the students to do their best at the end of the project.

RELATED STUDIES

In a research carried out by Meyer et al.⁷⁸, the problems faced by 14 fifth and sixth class students within the process of project based maths teaching were researched in five dimensions: taking academic risks, goals of success, self-sufficiency, will and influence. The data was collected through qualitative and quantitative techniques. The study resulted in important clues in terms of examining how students coped with problems in the course of academic studies such as project-based learning. The results of the study showed that motivation, will and influence played an important role in students' decision-making process. Although students are motivated to complete their projects, their goals and intentional strategies are different. Moreover, the importance of preparations for the project study such as the questions asked by the teacher in project-based learning has been emphasized.

In another study, Krajcik et al. carried out a case study on eight students. These students were registered to two different seventh grade science classes. According to the findings of this study, students were proficient enough at the steps of making a plan and realizing this plan. However, they had difficulty in (a) making meaningful scientific questions (b) managing time and complexity (c) using the data (d) developing a logical discussion to support the claims. Throughout the process, students made questions without examining the positive sides of the problem and they prepared questions according to personal preference rather than scientific content. They created research designs insufficient for the research questions they had prepared, they developed incomplete plans in terms of collecting data, they came to results without establishing a connection with the questions and they did not generally use all the data while coming to the conclusion. This result shows that students should be supported in the course of research⁷⁹.

In another research, Korkmaz and Kaptan⁸⁰ aimed at determining the impact of PBL approach in primary school science lessons on the academic successes, academic self-concepts and working hours of seventh grade students. Experimental design was used in the research. While science was taught by means of using PBL in experimental group, traditional methods were used during the lesson in the control group. The findings of the research show that there is a meaningful difference between the two groups to the favour of experimental group.

Özdemir⁸¹ investigated the impact of project based learning on the success of seventh grade students in geometry lesson and their attitudes towards geometry. In the research conducted at a private school with seventh grade students (n=24), the design of preliminary test and proof test with single group was implemented. Success tests of polygons, circles and cylinders apart from attitude scale of geometry, students' feedback form, teacher's observation scale and interviews were used in order to collect data. The findings show that project based learning improves the students' success of geometry and their attitudes towards geometry. Some of the factors that create this result are that: students constitute their own models, they deal with daily life problems that do not have just one solution and they decide on dimensions and areas through trial and error method. Moreover, it has also been observed that poor performing students' interests and wills to study have increased to a great extent.

In another research about PBL implementations, Moran⁸² studied with 24 teacher candidates who had been lectured on "methods of preschool teaching." The teacher candidates were randomly divided into groups of three or four. Teaching teams composed of each group carried out a project study with a small group of preschool students for six weeks. Ten volunteer candidates were involved in investigatory interviews. Here, the role of the candidates' educator was to provide the candidates with an atmosphere where they could form their own knowledge about learning and teaching process. However, at this step, since the candidates were accustomed to being presented ready information, they had difficulty in forming the information on their own. Because of this reason, it was very useful to have educator be ready there in order to guide the groups during the study in terms of finding answers for candidates' questions. But, in time, candidates started to be producers of potential new information about teaching by means of benefiting from their own experiences related to the situation. Throughout the research, the study of 15 weeks conducted with the candidates was carried out in three steps: 1. The phase of orientation: during this period which lasted 5-6 weeks, candidate wrote diaries, observed the children, recorded children's speaking and prepared documents. They watched the videos with a critical point of view. Thus, they experienced a preparation period to choose a project subject for themselves. 2. The phase of implementation: during the second step which lasted the next 6 weeks, the teams composed of 3-4 candidates implemented their projects together. The main focus of the lessons at this second step was that the candidates used class documents as a guide during the research. 3. The phase of interpretation: at this last step, teaching teams examined their projects for the last time for the sake of oral presentation and written reports. It supplied a lot of analytical tools, strategies and materials for the lesson to study in that way. In addition to this, candidates realized the importance and need to share responsibilities as a team while making decisions related to the programme.

Yıldırım⁸³ aimed at revealing the level of achieving research skills intended to be gained by 4. grade students by means of project based learning model and to determine the factors that influenced this level. Qualitative and quantitative methods were used in the research, which was designed test model. According to the findings, there was a meaningful difference between the research skills of students for whom PBL was implemented and the research skills of the students in the control group to the favour of experimental group. The students involved in PBL implementation stated that they found their level above average in self and group evaluation in terms of research skills whereas the teacher found the students below the average according to his/her own evaluation results. When the students of the experimental group were interviewed, they stated their satisfaction with cases such as participating in a project study, activities of research process, forming a project, reaching new information, learning solidarity, experiencing the feeling of success and the increase in their self-confidence.

In another study, Aladağ⁸⁴ examined the effect of PBL approach on the academic success of 4th grade students about teaching maths. The design of preliminary test- proof test with a control group was used in the research, which was carried out by means of using experimental design. According to the results, there was a meaningful difference between the success levels of students to the favour of the students who were in class of PBL.

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In another study by which the effectiveness of implementing integrated teaching programme with an approach based on cooperation and project based learning method was investigated, Demir⁸⁵, the findings show that the features (academic success, self-confidence, affective and social developments of students) observed when integrated teaching programme is implemented through learning techniques based on cooperation and the approach of project based learning are proved to be more effective.

Another set of studies investigated students' views about PBL. Some of the examples of these findings are stated as below.

Başbay and Ateş⁸⁶ reached to the conclusion that students had a positive opinion about PBL after the interviews with the students. Students emphasized that they could learn by means of using their own experiences with this approach, that they could learn how to study, that they had great time while learning, etc. Similarly, Wedel and others⁸⁷ conducted a research in which students emphasized that they could learn more in lesson of PBL when compared to other ones. In the study conducted by Frank and Barzilai⁸⁸, students also emphasized that they could establish an inter-disciplinary relation with PBL and they could develop this dimension that they could improve themselves to find solutions for different situations, that their self-confidence about learning increased.

In another study, by Lam et al.⁸⁹, the elements that contributed to the motivation of teacher about implementing PBL were investigated. 182 teachers participated in this study, which was conducted in Hong Kong. Teachers expressed their opinions through questionnaires. The design of structural equality was used in the study. According the results of the study, teachers perceived their schools as supportive for teacher sufficiency and so they had a higher motivation for implementing PBL. Moreover, the teachers participating in the study volunteered for educational innovations and social factors were also important about motivating teachers to implement educational innovations.

In another study on project based learning, Panasan and Nuangchalem⁹⁰ compared critical thinking and scientific process skills and learning successes of 5. Grade students who learnt through activities based on project based learning and research. The researchers divided 44 students into two groups. According to the findings, both project based and research based learning approaches had great impact on students' learning success and skills in terms of effectiveness.

Boundee et al.⁹¹ designed a learning-teaching model that would develop the cooperation-based learning of technical college students by means of using PBL on the web. The students were instructed to form projects by means of studying on the web together. This model increased students' real participation to the learning process and their motivation. Moreover, this model also helped students to develop cooperative study skills that would be useful for them in their daily lives and after graduation.

In another study on this subject, Dağ and Durdu⁹² received teacher candidates' opinions on the process of project based learning. In the study, which was conducted with the participation of 364 prospective teachers, the opinions of the candidates were studied under sub-dimensions such as the skills of group work and cooperation, research, resource, skills of time management and academic skills. In this study, a teaching period where PBL was used within the scope of computer lesson lectured in the faculties of education was designed. The results depending on the analysis of implemented questionnaires showed that students' skill to work in groups changed in a positive manner with project study while students had problems about sharing and carrying out tasks.

Doubtlessly, the studies on project-based learning are limited to the ones stated here. Researchers have carried out studies related to PBL implementations in many various disciplines (^{93,94,95}) and they have studied with students of all grades (⁹⁶) about project-based learning. Especially as a result of implementing this approach in primary and secondary schools, effective results have come out about communication and understanding (⁹⁷). Likewise, the reformative attempts about teaching maths

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started by maths teachers' council (1989) emphasize the importance of leaving memorization aside and making use of deeper learning methods such as application and problem solving. One of the ways to achieve these goals is to make use of project based learning designed for the purpose of having students involved in examining "original problems"⁹⁸.

It is definitely impossible to mention all the studies carried out about project based learning here. However, as can be understood from the given examples, project based learning is used at all levels from preschool teaching to university education. But, the success of PBL is parallel to teachers' knowing PBL well and using it in education in line with its principles.

SUMMARY

PBL is a method of learning, which accepts students as the center of learning process. The teacher guides students who follows the goals of the project or who design their own learning in a class where PBL is used⁹⁹. As emphasized by Dewey (1938), PBL is one of the educational approaches in which applied experiences are of vital importance in learning¹⁰⁰. PBL is a new approach which is student-centered and which operates with the guidance of the teacher. According to PBL approach, students form their own learning by means of producing projects that reflect their knowledge and doing research in teams as well as directing it by means of questioning. In other words, PBL is a learning model, which is arranged around projects¹⁰¹. PBL is based on problems and research questions that are formed with the contribution of students. There is research in the core of projects. Students determine the question they will search about with the guidance of the teacher. However, the key factor in this approach is student's own choice. The factor of choice is very important for student's success. The teacher controls all steps of the process. Students can have a deep understanding about a subject, they do deep reading about the subject and they are more motivated to learn with PBL. One of the key roles of PBL in learning is to bring up individuals who can think and learn effectively. Children solve real life problems by means of designing their own ways of search, they plan their own learning, and they use multi-dimensional learning strategies¹⁰².

PBL can be defined as an educational innovation that combines theory and application by means of using real life problems as a tool¹⁰³. In other words, project based learning is learner-focused strategy and it is an approach depending on gaining or forming knowledge through projects and transferring and using this knowledge when necessary¹⁰⁴. The use of PBL in the implementation period also ensures those who study for this project to focus on reflective studies. In other words, those who join the project by means of reflective applications can easily catch the products of project experience and the meaning of the project. Reflection is necessary for learning to turn wordless expressions into a clear information¹⁰⁵. In this sense, projects can be used as a tool to form reflective applications, to focus on research at all stages and to reach a common understanding. All these prove the importance of reflective applications for project-based learning. Those who learn through reflective applications can develop a multi-dimensional point of view, and this plays a facilitating role that will help them to struggle the problems they face¹⁰⁶. Moreover, some features such as using original question, using study society and technology-based tools attract attention about the definitions of project-based learning¹⁰⁷.

One of the important points of PBL is that there is no standard structure in a learning based on such an approach. There is a more complex way of study in PBL and processes take longer time. In general, PBL has got a flexible structure. It develops interaction between learners and the teacher as well as between learners themselves in the process of learning besides improving the skills of cooperative working. When learners complete their projects, they feel about the job they have done and this feeling motivates them to produce better projects in the future¹⁰⁸.

As a result, project based learning is a strong teaching strategy that encourages students to learn, that motivates them to learn by understanding, that arouses curiosity, that helps students to explore, that provides the students with the skills of problem solving and presents students the chance of implementing what they have learnt¹⁰⁹. PBL can be used effectively almost at all levels starting from

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primary school. It is also clear that PBL is used in many disciplines at universities today. Student-centered approaches, models, methods are tried and used in many fields. For example, student-centered approaches are used to prepare students for their professions in engineering¹¹⁰. Moreover, PBL comes to the forefront in many educational systems all over the world. For example, in Hong Kong education reform offer, PBL is defined as a teaching strategy that helps students to associate knowledge, skills, values and attitudes, and to form knowledge through various learning experiences¹¹¹.

Because of this reason, it will be possible to benefit from this approach more effectively just by means of knowing all the principles, advantages and limits of this approach and evaluating all these in terms of learning environments to be designed. It should be kept in mind that to know and to do are two different concepts. PBL is a teaching-learning model that puts these two concepts together¹¹².

REFERENCES

1. Senemoğlu, N. (2009) Gelişim, Öğrenme ve Öğretim, (14.Baskı), Ankara: Pegem Akademi.
2. Özçelik, D.A. (2009) Eğitim Programları ve Öğretim (Genel Öğretim Yöntemi), 2.Baskı, Ankara:Pegem Publication.
3. Bloom, B.S. (1998) İnsan Nitelikleri ve Okulda Öğrenme, Öğretmen Kitapları Dizisi, (Çev:D.A. Özçelik), İstanbul: MEB Publication.
4. Yıldırım, G. (1982) Öğrenme Düzeyi ve Ürünleri, İstanbul: Boğaziçi Üniversitesi Publication.
5. Saban, A. (2005) Öğrenme Öğretme Süreci (4.Baskı), Ankara: Nobel Yayın.
6. Saban, A., Mentioned Source
7. Keegan, A. & Turner, J.R. (2001) Quantity versus quality in project-based learning practices,management learning,32(1),77-98.(Downloaded from mlq.sagepub.com at Gazi Universityon September 26, 2011).
8. Petty, G. (1993) Teaching Today (A practical Guide), Cheltenham: Stanley Th ornes (Publishers)Limited.
9. Petty, G., Mentioned Source
10. Saracaloğlu, S., Özyılmaz Akamca, G., Yeşildere, S. (2006). İlköğretimde proje tabanlı öğrenmenin yeri, Türk Eğitim Bilimleri, 4(3), 241-258.
11. Doğanay, A. ve Tok, Ş. (2007) "Öğretimde Çağdaş Yaklaşımlar", Öğretim İlke ve Yöntemleri(Ed.A.Doğanay), Ankara: Pegem Publication.
12. Thomas, J.W.(2000) A review of research on project-based learning, ([http://www.bie.org/research/study/review of project based learning](http://www.bie.org/research/study/review_of_project_based_learning), 2000)
13. Reece, I. & Walker, S. (1997) Teaching training and learning (a practical guide), 3rd edition,Sunderland: Business Education Publishers Limited.
14. Thompson, K.J. & Beak, J. (2007) The leadership book: enhancing the theory-practice connectionthrough project-based learning, Journal of Management Education, 31(2), 278-291.
15. Petty, G., Mentioned Source
16. Saracaloğlu, S., Özyılmaz Akamca, G., Yeşildere, S. , Mentioned Source
17. Sönmez, V. (2007) Öğretim İlke ve Yöntemleri, Ankara: Anı Publication.
18. Arthur, M.B. ; DeFillippi, R.J. & Jones, C. (2001) Project-based learning as the interplay ofcareer and company non-financial capital, Management Learning, 32 (1), 99-117.(Downloaded from mlq.sagepub.com at Gazi University on September 26, 2011).
19. Senemoğlu, N., Mentioned Source
20. Thomas, J.W., Mentioned Source
21. Petty, G., Mentioned Source
22. Thomas, J.W., Mentioned Source
23. Moran, M.J. (2007) Collaborative action research and project work: promising practices for developing collaborative inquiry among early childhood preservice teachers, Teaching and Teacher Education, 23, 418-431.

24. Dođanay, A. ve Tok, Ő. (2007) "Öđretimde ađdaŐ YaklaŐımlar", Öđretim İlke ve Yöntemleri(Ed.A.Dođanay), Ankara: Pegem Publication.
25. BaŐbay, M. (2007) Proje Tabanlı Öđrenme, Eđitimde Yeni Yönelimler (Ed.: Ö.Demirel), 2.Baskı, Ankara: Pegem Publication.
26. YeŐildere, S.ve Turnuklu, E.B. (2006) The effect of project-based learning on pre-service primary mathematics teachers' critical thinking dispositions, International Online Journal of Science and Mathematics Education, (6), 1-11.
27. Thomas, J.W., Mentioned Source
28. Thomas, J.W., Mentioned Source
29. BaŐbay, M., Mentioned Source
30. Gözütok, D. (2007) Öđretim İlke ve Yöntemleri, 2. Baskı, Ankara: Ekinoks.
31. Thomas, J.W., Mentioned Source
32. Erdem, M. ve Akkoyunlu, B. (2002) İlköđretim sosyal bilgiler dersi kapsamında beŐinci sınıf öđrencileriyle yürütölen ekiple proje tabanlı öđrenme üzerine bir alıŐma, İlköđretim- Online(1) 2-11.
33. Frank, M. & Barzilai, A. (2004) Integrating alternative assessment in a Project-based learningcourse for pre-service science and technology teachers, Assessment & Evaluation in Higher Education, 29 (1), 41-61.
34. Thomas, J.W., Mentioned Source
35. Saracalođlu, S., Özyılmaz Akamca, G., YeŐildere, S., Mentioned Source
36. Thomas, J.W., Mentioned Source
37. Dođanay, A. ve Tok, Ő., Mentioned Source
38. Saracalođlu, S., Özyılmaz Akamca, G., YeŐildere, S. , Mentioned Source
39. Gözütok, D. , Mentioned Source
40. Saracalođlu, S., Özyılmaz Akamca, G., YeŐildere, S. , Mentioned Source
41. Dođanay, A. ve Tok, Ő, Mentioned Source
42. Erdem, M. (2002) Proje tabanlı öđrenme, Hacettepe Üniversitesi Eđitim Faköltesi Dergisi, 22, 172-179.
43. Thomas, J.W., Mentioned Source
44. Gözütok, D. , Mentioned Source
45. ıbık, S.A. (2006) Proje Tabanlı Öđrenme YaklaŐımının Fen Bilgisi Dersinde Öđrencilerin Mantıksal Düşünme Becerilerine Ve Tutumlarına Etkisi, ukurova Üniversitesi Sosyal Bilimler Enstitüsü, İlköđretim Anabilim Dalı,Yüksek Lisans Tezi.
46. Gözütok, D. (2007) Öđretim İlke ve Yöntemleri, 2. Baskı, Ankara: Ekinoks.
47. Erdem, M. ve Akkoyunlu, B., Mentioned Source
48. ıbık, S.A. , Mentioned Source
49. Senemođlu, N. Mentioned Source
50. Frank, M. & Barzilai, A. , Mentioned Source
51. Reece, I. & Walker, S. , Mentioned Source
52. Thomas, J.W., Mentioned Source
53. ıbık, S.A. (2006) Proje Tabanlı Öđrenme YaklaŐımının Fen Bilgisi Dersinde Öđrencilerin Mantıksal Düşünme Becerilerine Ve Tutumlarına Etkisi, ukurova Üniversitesi Sosyal Bilimler Enstitüsü, İlköđretim Anabilim Dalı,Yüksek Lisans Tezi.
54. Saracalođlu, S., Özyılmaz Akamca, G., YeŐildere, S., Mentioned Source
55. Gözütok, D., Mentioned Source
56. BaŐbay, M. ve AteŐ, A. , Mentioned Source
57. ıbık, S.A. , Mentioned Source
58. Grant, M.M. (2002) Getting a grip on project-based learning: theory, cases and recommendations, Meridian: A Middle School Computer Technologies Journal, 5(1).
59. Frank, M. & Barzilai, A. , Mentioned Source
60. Reece, I. & Walker, S. , Mentioned Source
61. Korkmaz, H. ve Kaptan, F.(2002) Fen eđitiminde proje tabanlı öđrenme yaklaŐımının ilköđretim öđrencilerinin akademik baŐarı, akademik benlik kavramı ve alıŐma sürelerine etkisi, Hacettepe Üniversitesi Eđitim Faköltesi Dergisi, 22, 91-97.
62. ıbık, S.A. , Mentioned Source

LEARNING AND TEACHING : THEORIES, APPROACHES AND MODELS

63. Postholm, M.B. (2006) Assessment during project work, *Teaching and Teacher Education*, 22, 150-163.
64. Van den Bergh, V.; Mortelmans, D.; Spooren,P.; Van Petegem,P.; Gijbels,D. & Vanthournout, G.(2006) New assessment modes within project-based education–the stakeholders, *Studies in Educational Evaluation*, 32, 345–368.
65. Petty, G. , Mentioned Source
66. Markham, T. (2011) Project baded learning-a bridge just far enough, *Teacher Librarian*, 39 (2), 38-42),December.
67. Petty, G., Mentioned Source
68. Çakmak, M. (2011) Changing roles of teachers: pre-service teachers' thoughts, *Eğitim ve Bilim*, 36 (159), 14-24.
69. Senemoğlu, N., Mentioned Source
70. Doğanay, A. ve Tok, Ş. (2007) "Öğretimde Çağdaş Yaklaşımlar", *Öğretim İlke ve Yöntemleri* (Ed.A.Doğanay), Ankara: Pegem Publication.
71. Frank, M. & Barzilai, A., Mentioned Source
72. Th omas, J.W., Mentioned Source
73. Frank, M. & Barzilai, A. , Mentioned Source
74. Th ompson, K.J. & Beak, J. , Mentioned Source
75. Petty, G., Mentioned Source
76. Lam, S-f., Cheng, R.W-y., & Choy, H.C. (2010) School support and teacher motivation to implement project-based learning, *Learning and Instruction*, 20, 487-497.
77. Markham, T. (2011) Project baded learning-a bridge just far enough, *Teacher Librarian*, 39 (2), 38-42),December.
78. Meyer, D.K.; Turner,J.T. & Spencer, C.A. (1997) Challenge in a mathematics classroom: students' motivation and strategies in project-based learning, *The Elementary School Journal*, 97(5), 501-521.
79. Th omas, J.W., Mentioned Source
80. Korkmaz, H. ve Kaptan, F., Mentioned Source
81. Özdemir, E. (2006) An investigation on the effects of project-based learning on students' achievement in and attitude towards geometry (Proje tabanlı öğrenmenin öğrencilerin geometri başarılarına ve geometriye yönelik tutumlarına etkisinin araştırılması), A Master Thesis, The Graduate School of Natural And Applied Sciences Of Middle East Technical University, Ankara.
82. Moran, M.J. (2007) Collaborative action research and project work: promising practices for developing collaborative inquiry among early childhood preservice teachers, *Teaching and Teacher Education*, 23, 418-431.
83. Yıldırım, S. (2007) İlköğretim 4. sınıf sosyal bilgiler dersinde proje tabanlı öğrenme modelininaraştırma becerilerinin gerçekleşme düzeyine etkisi, Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü (Yüksek Lisans Tezi), İstanbul.
84. Aladağ, S. (2008) İlköğretim Matematik öğretiminde proje tabanlı öğrenme yaklaşımının öğrencilerin akademik başarısına etkisi, *TSA*, 12(2), 157-170. 166 Öğrenme ve Öğretme
85. Demir, K. (2008) Bütünleştirilmiş Öğretim Programının İşbirliğine Dayalı Ve Proje Tabanlı Öğrenme Yaklaşımıyla Uygulanmasının Etkililiği, Yüksek Lisans Tezi, Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.
86. Başbay, M. ve Ateş, A. , Mentioned Source
87. Wedel, M.K.; Boldizar, A. and Malmqvist, J. (2005) Active learning through group dialogue in a project-based course on environmentally adopted product development, 1st Annual CDIO Conference, Canada.
88. Frank, M. & Barzilai, A., Mentioned Source
89. Lam, S-f., Cheng, R.W-y., & Choy, H.C. , Mentioned Source
90. Panasan, M. & Nuangchalerm, P. (2010) Learning outcomes of project-based and inquiry based learning activities, *Journal of Social Sciences*, 6(2), 252-255.
91. Boondee, V., Kidrakarn, P., & Sa-Ngiamvibool, W. (2011) A Learning Model using Project Based Learning (PBL) on the Web to Promote Cooperative Learning, *European Journal of Social Sciences*, 21(3), 498-506.
92. Dağ, F. & Durdu, L. (2012) Öğretmen adaylarının proje tabanlı öğrenme sürecine yönelik görüşleri, *NWSA-Education Sciences*, 7(1), 200-211.

LEARNING AND TEACHING : THEORIES, APPROACHES AND MODELS

93. Scarbrough, H., Bresnen, M., Edelman, L.F., Laurent, S., Newell, S. and Swan, J. (2004) The processes of project-based learning: an exploratory study, *Management Learning* 35(4), 491-506
94. Poell, R.F.; Yorks, L. & Marsick, V.J. (2009) Organizing project-based learning in work contexts: a cross-cultural cross analysis of data from two projects, *Adult Education Quarterly*, 60(1), 77-93.
95. Thompson, K.J. & Beak, J., Mentioned Source
96. Thompson, K.J. & Beak, J. Mentioned Source
97. Thomas, J.W., Mentioned Source
98. Meyer, D.K.; Turner, J.T. & Spencer, C.A. (1997) Challenge in a mathematics classroom: students' motivation and strategies in project-based learning, *The Elementary School Journal*, 97(5), 501-521.
99. Boondee, V., Kidrakarn, P., & Sa-Ngiamvibool, W. (2011) A Learning Model using Project Based Learning (PBL) on the Web to Promote Cooperative Learning, *European Journal of Social Sciences*, 21(3), 498-506.
100. Lam, S-f., Cheng, R.W-y., & Choy, H.C., Mentioned Source
101. Panasan, M. & Nuangchalerm, P., Mentioned Source
102. Bell, S. (2010) Project-based learning for the 21st century: skills for the future, *The Clearing House*, 83, 39-43. *Proje Tabanlı Öğrenme* 167
103. Van den Bergh, V.; Mortelmans, D.; Spooren, P.; Van Petegem, P.; Gijbels, D. & Vanthournout, G. (2006) New assessment modes within project-based education—the stakeholders, *Studies in Educational Evaluation*, 32, 345–368.
104. Poell, R.F.; Yorks, L. & Marsick, V.J. (2009) Organizing project-based learning in work contexts: a cross-cultural cross analysis of data from two projects, *Adult Education Quarterly*, 60(1), 77-93.
105. DeFillippi, R.J. (2001) Introduction: project-based learning, reflective practices and learning outcomes, *Management Learning*, 32(1), 5-10.
106. Ayas, K. Ve Zeniuk, N. (2001) Project-based learning: building communities of reflective practitioners, *Management Learning*, 32 (1), 61-76.
107. Thomas, J.W., Mentioned Source
108. Boondee, V., Kidrakarn, P., & Sa-Ngiamvibool, W. (2011), Mentioned Source
109. Çibik, S.A. Mentioned Source
110. Schaffer, S. P., Chen, X., Zhu, X. & Oakes, W.C. (2012) Self-efficacy for cross-disciplinary learning in Project based learning, *Journal of Engineering Education*, 101(1), 82-94.
111. Lam, S-f., Cheng, R.W-y., & Choy, H.C., Mentioned Source
112. Markham, T., Mentioned Source