Implementation of Project-Based Learning in Secondary Schools

Isil Gulmez
Vice-principal, Fatih Sultan Mehmet Ortaokulu,
Ulus Mah. Su Deposu Cad. Nobila, Yildirim, Bursa, Turkey.
E-mail: isilgulmez@yahoo.com

Abstract
The purpose of this study is to use project-based learning model for creating collaborative games in computer science lesson. Survey model was used in the study. In scope of the study, an etwinning project was conducted with 163 students and teachers of 14 schools from various countries such as Spain, Portugal, Poland, Serbia, Bulgaria, Greece, Turkey, Romania, Croatia and Iceland. Etwinning platform and Edmodo webpage were used for ensuring communication and cooperation between participants in the project. As a result of the project, partners created their own games in groups using Scratch tool. All created games and the process of creating games were collected in an e-book. At the end of the study, opinions of teachers and students were collected through interviews. Results showed that teachers found project creative, encouraging and interesting. The students deemed the project as an opportunity to work together, communicate and sharing and see their own errors.
Keywords: Project Based Learning, games, coding

1. Introduction

Educational institutions require structural educational reform for being included into cooperative implementations to meet demands of the age of globalization. Project-based learning (PBL) has a significant potential between structural education reforms (Fox 2013). Therefore, educational institutions should provide students opportunities to do real-world work, engage in projects that require teamwork and collaboration throughout academic careers (Liebtag & Vander 2016).

PBL is a systematic teaching method that engages students in learning process through an extended inquiry structured around complex authentic questions and carefully designed products and tasks (Markham et al. 2003 pp.4). During PBL, students cooperate to solve problems, test their ideas and present their project to others (Wurdinger, Haar & Bezon 2007). PBL is accepted as an approach motivating students and developing schools (Blumenfeld et al. 1991; Grant & Branch 2005; Levine 2002; Littky & Grabelle 2004; Newell 2003; Thomas et al. 2005). PBL offers an engaging instructional method to make learners active constructors of knowledge (Grant 2002). Nowadays, web-based platforms that provide students an opportunity to design new environments, are popular examples of construction. One of these platforms provide students an environment to design their games instead of playing. Kafai (2001) states that students generate constructivist ideas while building their games. They build their own world by constructing their own games.

The needs for collaboration and exchanging ideas between schools from different countries are obvious. Informations and Communications Technology (ICT) supported school partnerships are a suitable solution to transfer practices and to support mutual learning (Velea 2012). In this regard, schools should support collaborative learning environments using web based partnerships. Today, coding is a wide and significant concept in the field of information technologies. Coding is the phase to write a program for finding a solution to a problem by small steps (Demirer & Sak 2016). In many countries such as Belgium (Dutch community), Bulgaria, Cyprus, Denmark, Estonia, Spain, Finland, France, Greece, Luxembourg, Ireland, Italia, Netherlands, Norway, Portugal, Turkey and England, students are learning coding at small ages (Balanskat & Engelhardt 2014). There are some challenges that teachers face during teaching coding. Most common challenges are having limited time and not having necessary skills for computer programming. Therefore, the researchers seek constructive methods for students to create games (Siko & Barbour 2013). Some programming platforms were designed to simplify coding and make it easier to understand by the students. (Resnick 2009). An example of these programming platforms is an open source programming language called Scratch

(http://scratch.mit.edu/) developed at Massachusetts Institute of Technology ensuring students between ages of 8 and 16 to create stories, games and artworks (Resnick 2009). This platform enables the students to realize their own designs by coding.
The literature regarding PBL frequently stated the advantages, challenges and suggestions on methods of PBL. Yet, there are very few examples of PBL through school partnerships. To fill this gap in the literature, examples of lesson designs for using collaborative projects are required. This study aims to contribute the literature by providing a PBL example which may be integrated into computer science cirruculum. In scope of the study, it is aimed to teach the students of 5th and 6th grades the basic concepts of programming via cooperative game design project.

2. Background

2.1. PBL

School reform efforts are widespread all over the world. Constructivist approaches hold promise for increasing both student achievement and motivation. One of the most popular approaches of constructivist learning methods is PBL (Fox 2013).

2.1.1. History of PBL

PBL roots date back to early progressive educators (Pecore 2015). Some scholars assert that the concept of PBL was established by John Dewey's "learning by doing" in early 1900s (Yusof, Daniel, Low & Aziz 2015). Scholars also refer to William Heard Kilpatrick, a follower of John Dewey's educational philosophies, as the implementer of PBL concept (Meyer 2015). Kilpatrick discussed PBL in his article "Project Method" (Fox 2013). In PBL students work cooperatively towards the creation and public exhibition of a meaningful product (e.g. simulation, game, story, pamphlet, video, play, model, website, etc.) that represents their construction of meaningful knowledge. (Robertson 2012).

2.1.2. Definition of PBL

PBL is a learning approach where learners are encouraged to find solutions to problems by actively participating in the learning process. PBL is centered on the learner and affords learners the opportunity for in-depth investigations (Harris & Katz 2001). Newell (2003) defines PBL as a process that emphasizes student interest rather than following a fixed curriculum; a broad, interdisciplinary focus rather than a narrow, discipline-based focus. PBL uses direct, primary, or original sources rather than texts, lectures, and secondary sources; data and materials developed by students rather than teachers. Wurdinger, Haar & Bezon (2007) and Chard (2011) define PBL as an approach that enables teachers to guide students through in-depth studies of real-world topics. Erol, et al. (2012) emphasize that PBL is a constructivist pedagogy which intent on bringing about deep learning using inquiry based approach. Buck Institute for Education defines PBL as a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge (BIE 2017).
There are many different definitions of PBL. Eventhough PBL has many definitions, the most significant components of the model are a) a question or a problem, b) production of one or more works indicating the learning.

2.1.3. Why Is PBL Important?

PBL is effective for giving the students the ability to develop the skills of 21st century such as cooperation, communication, critical thinking and digital sufficiency while working in small groups to realize a common duty together in PBL. PBL facilitate meaningful learning, develops independent learner proficiency (Vidergor & Harris 2015). Researches emphasizes that PBL allows development of self-direction and communication skills (Boss & Krauss 2007). PBL provides the strategy necessary for access to wide learning oppurtunities in class and participation of culturally different learners to class activities (Railsback 2002). PBL has the potential to integrate the cooperation and teamwork through informal social discussions and peer evaluations of individuals and student teams during the project (Grant 2011). Students gain a deeper understanding of the concepts and standards in the project while researching and investigating. PBL develops creativity and innovative skills. PBL also contribute to enhancing problem solving and higher order thinking skills of the learners (Morgan, Capraro & Capraro 2013; Pinho-Lopes & Macedo 2014; Vidergor & Harris 2015). PBL helps students gain new insights (Krauss & Boss 2013). It increases students' self-confidence (Zheng 2017). PBL also increases academic performance of students (Wurdinger, Haar and Bezon 2007). Halvorsen et al. (2012), research results indicate that students with lower academic success could reach the level of achievement of their high-SES counterparts. Students who participate in projects take greater

responsibility for their learning (Intel Teach Program 2007; Fox 2013). In project-based learning students are responsible for design and management of their learning (Boss and Krauss 2007; Jackson 2012). Students have active role such as problem solving, decision making, researching and documentation. Students can also choose their research design of their interest (Intel Teach Program 2007). By this way, the students will actively control their education (Gilleran & Kearney 2014). PBL develops student attitudes against learning (Çubuk 2009; Markham 2011) and motivates students (Liu & Hsiao 2002; Wurdinger, Haar & Bezon 2007; Grant 2011: Jackson 2012; Fox 2013; Morgan, Capraro & Capraro 2013).

PBL has additional benefits for teachers such as professionalization and cooperation between colleagues, create relations with students (Thomas 2000). The benefits of PBL stated by the teachers are active, interesting, compliant, automonous, self-directed learning, communication skills and motivation (Wurdinger, Haar and Bezon 2007). In additions, teachers stated that PBL increased the problem-solving skills of the students. These results indicate that PBL increases the motivation and participation of the students for realizing specific purposes (Wurdinger, Haar and Bezon 2007). Researchers emphasize importance of implementing PBL on student engagement, enhancing student motivation, preventing absence, supporting cooperative learning skills and increasing academic success. Another significant aspect of the projects is that they allow students to take responsibility for their education. This is ensured by giving students a right to choose their subjects and decide roles they will undertake for the implementation of the project. PBL leads students to make inquiry in response to a real-world problem. During the inquiry process, students work collaboratively, in teams or small groups, to solve the problem.

2.1.4. Challenges of PBL

Educators face various challenges implementing PBL. Most common challenging factors are time constraints (Thomas 2000; Frank & Barzial 2002; Fox 2013; Harris 2014), classroom management (Thomas 2000; Fox 2013), control (Thomas 2000; Fox 2013), coping with conflict (Frank & Barzial 2002), project definition (Thomas 2000; Fox 2013), workload (Fox 2013), student needs (Thomas 2000; Fox 2013), increasing efforts of teacher and student and coping with new contents in a learning environment (Frank & Barzial 2002) using technology (Thomas 2000; Fox 2013), and evaluation (Thomas 2000; Fox 2013).

Time. Projects mostly take longer than expected. Teachers may experience problems regarding time management (Thomas 2000; Frank & Barzial 2002; Fox 2013; Harris 2014).

Class Management. Teachers are required to allow students to work by themselves. This situation may cause problems (Thomas 2000; Fox 2013). Rogers (2014) emphasizes challenges such as lack of guideline, time and need for planning, assessment methods and motivation.

Control. While teachers believe that the students need to create their own meanings, they mostly try to check the information flow and this may cause problems (Thomas 2000; Fox 2013). Frank & Barzial (2002), reports coping with conflict situations in the teamwork.

Project Definition. Teachers may have difficulties on defining projects to solve real life problems and meets necessities of the curriculum (Thomas 2000; Krishnan 2011; Fox 2013).

Increasing workload in planning. Teachers require more time and workload for PBL and in-depth approaches (Frank & Barzial 2002; Fox 2013). Krishnan (2011), states that teachers have difficulties on designing PBL that meets curricular requirements, choosing real life problems and monitoring the process.

Meeting needs of each student. Teachers may have difficulties on responding needs of individual students (Thomas 2000; Fox 2013).

Using technology. Teachers may have difficulties on including the technology into class as a learning tool (Thomas 2000; Fox 2013).

Evaluation. Teachers may have difficulties on designing assessment tools can help them understand what their students learned (Thomas 2000; Fox 2013).

Fox (2013), report that challenges which may be experienced by the teachers include:

1) Ensuring necessary conditions to develop good projects
2) Constructing problems as an opportunity to learn
3) Cooperate with collegues to develop interdisciplinary projects
4) Managing the learning process
5) Integrating appropriate technologies
6) Developing authentic evaluations (Fox 2013).

Many teachers may consider PBL difficult in terms of planning, managing and evaluating, yet they may benefit from the supportive contents of PBL (Fox 2013).

2.1.5. Examples of PBL

The methodology of PBL is being implemented in various countries and studies are being conducted regarding these implementations. At New Technology High School in California, the project approach is the cornerstone of instruction for the entire school spread to a growing network of schools across the U.S. PBL is a national aim in Singapore. Teachers in Scotland are forming a professional communities on "extreme learning" (Boss and Krauss 2007).

Laboy-Rush (2011) emphasizes the significance of project-based STEM education that teachers encourage students to solve problems in Science, Technology, Engineering and Math fields. The researchers implemented an interdisciplinary STEM project in their study. Their project was aimed to create a community model in Mars by students of 3^{rd} -8^{th} grade with guidance of teachers.

There are various PBL examples in literature changes in terms of content and implementation. Jackson (2012), addresses 4 subjects that typical projects focus around: 1) Solving a problem (How can we stop bullying in schools?) 2) Designing a model (Developing a model of a new playground structure) 3) Investigating a phenomenon (Why do you stay on your skateboard?) 4) Making a decision (Should our neighbourhood build a community centre?) (Jackson 2012).

2.1.6. Phases Of PBL

In project-based science, the focus is on a driving question to guide an investigation (Blumenfeld vd. 1991). Students start with a driving question. To answer the question. students make experiments in teams, collect data, decide how to analyze data, learn what it means and present results. This research takes a long time and requires students to work with each other (Grant 2002).

Grant (2002) categorized the phases of PBL as (a) introduction (b) driving question (c) a process or investigation (d) suggested resources (e) scaffolding to help learners assess their progress (f) collaborations (g) opportunities for reflection and transfer.

Intel Teach Program (2007) describes stages of PBL model as (a) a problem without an answer (b) an atmosphere tolerating the errors and changes in the class (c) decisions with a framework (d) design the process for reaching a solution (e) reflect on the activities (f) continious assessment (g) a final product results.

Larmer and Mergendoller (2010) emphasizes 7 phases of PBL in their study:

1. Needs to know: The teachers start an investigation with an introductory activity such as video, discussion, guest speaker, field trip while starting a project.
2. Driving question: A question which gives students a sense of purpose and challenge may be asked for a purpose.
3. Student voice and choose: The voice and preference of the student have a value to make project feel meaningful to students. Students can decide which products they will create, Students could even choose a project's topic and driving question.
4. 21^{st} Century Skills: The project must support 21^{st} century skills such as cooperation, communication, critical thinking and the use of technology.
5. Inquiry and Innovation: Students find project work more meaningful if they conduct real inquiry. In real inquiry, students begins with their own questions, leads to a search for resources and the discovery of answers,
6. Feedback and Revision: Formalizing a process for feedback and revision during a project makes learning meaningful. Apart from the direct feedbacks, the teachers may coach students in using rubricks or other criteria.
7. A Publicly Presented Product: Projects are more meaningful when students present their work to a real audience. The schools must provide support for presentation of projects.

In Researches, most important component of PBL is driving question. Driving question makes student focus on project topic. Learning environment, continuous and final assessment was emphasized regarding PBL.

According to Wrigley (1998), all projects have common phases; identification of a problem or issue; preliminary investigations; planning and assigning tasks; researching the topic; implementing the project, drafting and developing a final product; disseminating; and evaluating what worked (Wrigle 1998). Grant (2011) added collaboration, teams, peer review, external experts to common phases of PBL.

According to Markham (2011), the necessary principles for design of PBL are given as below:

1. Begin with the end in the mind. Great projects begin planning for the end results. Teacher designs manageable projects with engaging themes and high standards.
2. Craft the Driving Question. The teacher uses driving question to engage students.
3. Plan the Assessment. At the end of the project, the students obtain a result from PBL. This result must be clearly defined in assessment plan at the beginning of the project.
4. Plan Backwards. The teacher must provide coaching, about how to do collaboration right and how to do presentation, to the students during the process in PBL.
5. Enroll and Engage. Best project applications are those which engages students in the project.
6. Facilitate the Teams. Best PBL is based on teams focusing on same aims, purposes and results.
7. Keep the End in Mind. PBL process is a problem solving process and the teacher must manage the workflow and prepare the students to present the best products (Markham 2011).

Patton (2012) defined the necessary steps for PBL in detail:

1. Get an idea: The beginning of the project takes different forms: it could be a question, or it could be a product developed by the students or it could even be an exhibition venue to take advantage of.
2. Design the Project: Teacher must decide what they want students to learn, and plan 'backwards' from there.
    a. There must be learning aims.
    b. As a result of the project, expected learning outputs must be defined.
    c. Provide checklists for tasks and assignments that are given to students. There must be planned series of 'check-ins' to take place throughout the project to make sure students are on track. These may be short papers, quizzes, journal entries, meetings with the teacher, and critiques.
    d. Sources of assessment -having assessment data from a variety of sources is essential to PBL,
        d.i. Self-assessment – It ensures student to take responsibility for his/her learning and education.
        d.ii. Peer-assessment– This evaluation allows students to be evaluated individually.
        d.iii. Teacher assessment – This is the evaluation of the teacher in scope of the project.
        d.iv. External Expert / Viewer Evaluation – This evaluation can take place during exhibition of the activity.
        d.v. Check List: • A model of the product that students will be creating • A full project plan • A project timeline • A 'project sheet' for students, parents, and partners from outside the school, that describes the project, lists the milestones, and explains the plan for exhibition and assessment.
3. Tune the Project: The teachers present present their plans to a group of colleagues to get feedback.
4. Do the Project: The model of the product which students may create may be presented.
5. Exhibit the Project: Here is booking the exhibition venue should be one of the first things to do when planning a project. There are lots of possible venues for exhibitions: museums, galleries, parks, cafes, churches, community centres, etc. Students may promote exhibition in a variety of ways: for example, posters, distributed flyers, social networking links, local radio and television stations.

While implementing PBL, one or two hours per week seems in non-intensive classes. In order to keep students focused on the work, frequent drafts of products is beneficial (Wrigley 1998).
According to Krauss and Boss (2013), PBL implemented in schools should ensure the conditions given below:

1) Creating conditions where students can research real world issues;
2) Asking open ended questions to create the necessary meaning;
3) Considering the preference of the student over the process and the product;
4) Students striving to find solutions for complex problems connected with real life;
5) Ensuring that students learn with each other;
6) Subject must be meaningful for students;
7) Students can be affected by their learnings;
8) Technology is used for researching and constructing new meanings and reaching the learning communities out of the classes (Krauss & Boss 2013).

2.1.7. Roles of Teachers and Students in PBL

PBL has changed teachers' role. Teachers are no more an expert of content that separates the information into small pieces (Boss & Kraus 2007). Blumenfeld et al. (1991) explained the roles of teachers in successful PBL implementations:

a. Create opportunities for learning by providing access to information;
b. Support learning by scaffolding instruction and guiding the students to make tasks more manageable;
c. Encourage students to use learning and metacognitive processes;
d. Assess progress, diagnose problems, provide feedback and evaluate overall results (p. 381).

The behaviors of students have also changed. Instead of following the leadership of the teacher, students ask their own questions to create their own meanings. Students use information they have obtained to develop authentic products. The projects give opportunities of student choice, active learning environment and teamwork (Boss & Kraus 2007).

Wurdinger, Haar and Bezon (2007) emphasized cooperative works for PBL in their study. They suggest teachers to support student project by ensuring that the students individually or in groups, solve the problems by testing their ideas and present their projects to their groupmates. They also suggest teachers to allow students work independently in specific periods (Wurdinger, Haar and Bezon 2007).

2.1.8. Tools for Project Based Learning

Etwinning is an Europeans initiative which can be used for creating partnerships between schools. Etwinning program was initiated as a part of Comenius Lifelong Learning Program in 14th January 2005 (Velea 2012). ETwinning is a community constituting of approximately 400,000 teachers and 2,000,000 students (Cassells, Gilleran, Morvan and Scimeca 2016). Etwinning provides private space called Twinspace for project partners to collaborate with their peers and conduct common projects. Etwinning awards the teachers for the efforts in activities and projects with a system called Quality Label and with certificates (Cassells, Gilleran, Morvan and Scimeca 2015). Etwinning became an advantageous platform for supporting the school transformation and affect the teaching and learning. The teachers participating in Etwinning projects state that it increases the students' motivation to learn (Velea 2012). Etwinning has a great effect to develop the relations between the teacher and students. According to participating teachers, the biggest impact of eTwinning over students is the increase of their motivation. Through Etwinning teachers include 21st century tools to their daily teaching (Kearney and Gras-Velázquez 2015).

Web 2.0 tools are a group of web-based technologies that expand communication capabilities and options. These tools include blogs, wikis, multimedia sharing services, content syndication, podcasting and content tagging services (Anderson 2007). CIBER & Emerald (2010) listed the most preferred Web 2.0 tools in their study. According the research Doodle is among the most preferred meeting tools. Doodle is a scheduling and voting tool that gives people living in different time zones an opportunity to schedule meetings. This system creates dates and times suitable for everyone. Each group member replies the email they receive for determining suitable times for meeting (White 2012). The user interface of Doodle tool is shown in Figure 1.

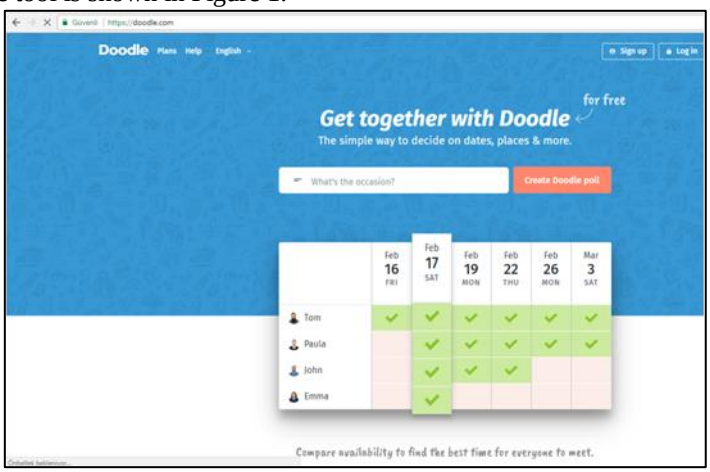

Figure 1 Doodle tool user interface. Source: White, C.M. (2012). Social Media, Crisis Communication, and Emergency Management. CRC Press Taylor & Francis Group, Sound Parkway NW

As given in Figure 1, users choose a specific date and time on a month. Doodle tool is effective for taking decisions in restricted times for decreasing the necessary time for scheduling the tasks. Leigh and Schultheis (2010) used an online scheduling tool, to place students in groups according to their interests in their project.

Edmodo is common used social learning network which uses web 2.0 technologies. Edmodo is an educational platform which is commonly used in primary and secondary schools and is frequently seen as the educational version of facebook. (McKim 2016). Through Edmodo teachers can create groups that students can join. Teachers can create quizzes (which can be evaluated by the system), send individual or group messages to students, manage teamwork, tasks and schedule appointments (Végh, Nagy, , Zsigmond & Elbert 2017). Edmodo (see Figure 2) allows educators to harness the power of social media in educational environments. For teachers and students, it provides a safe environment for cooperation, feedback, personalized learning etc.

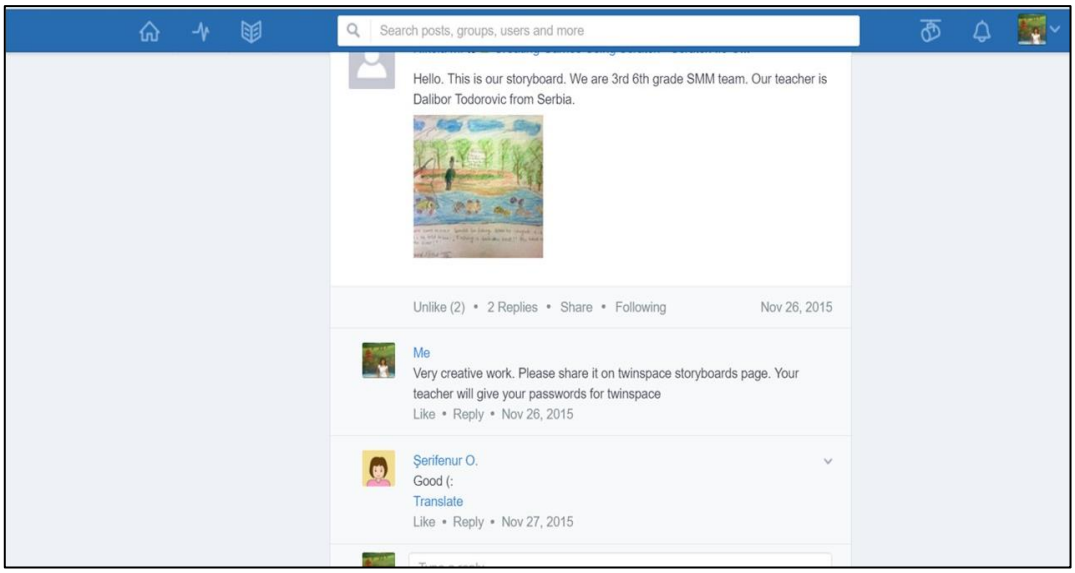

Figure 2 Screenshot of Edmodo interface

As seen in Figure 2, teachers can create groups for their class in Edmodo environment and share files, pictures and videos. Member of the groups can like or comment on the shared contents.

2.2. Learning with Games

Educational institutions need to teach 21st century skills to adapt changes and innovations of our age. Spires, Lee and Lester (2008)'s study emphasizes the potential of the games for teaching 21st century skills. According to Beck and Wade (2004) games improve gamers' skills such as analyzing new situations, interacting with characters, solving problems quickly and independently, thinking strategically in a chaotic world and collaborating effectively in teams.

One of the most used tool that helps users design games is Scratch tool (see in Figure 3). Scratch is a tool that supports 21st century skills such as cooperation, problem solving and innovation (Peppler and Kafai 2007). Scratch is a project of the Lifelong Kindergarten Group at the MIT Media Lab. With Scratch students can program their own interactive stories, games, and animations and share their creations with others in the online community. Scratch helps young people learn to think creatively, reason systematically, and work collaboratively (scratch.mit.edu).

Scratch enables students to program with a mouse, presenting programmatic constructs as blocks that only fit together if syntactically appropriate (Malan and Leitner 2007). Scratch represents many intentional choices, personal, social, pedagogical, and cultural. Scratch gives student opportunities for informal learning through online community. Study found out that informal learning has impact on student engagement (Peppler and Kafai 2007). The web page of Scratch, scratch.mit.edu has a community where the users may learn from each other (Siko and Barbour 2013).

Figure 3 Scratch platform screenshot

3. Method

In the study, survey model was used. Study involves a project which aims to write collaborative game with 14 partner schools from Spain, Portugal, Poland, Serbia, Bulgaria, Greece, Turkey, Romania, Croatia and Iceland. The study lasted 17 weeks. Students used programming concepts such as variable, loop and conditions through Scratch for a basic game project with the guidance of teachers.

3.1. Study Group

The study was conducted with teachers and 163 students from 14 schools in 11 countries, namely Spain, Portugal, Poland, Serbia, Bulgaria, Greece, Turkey, Romania, Croatia and Iceland. 4 student groups consisting of 3 to 4 people participated from each school for the study.

Participating Schools

- Osnovna škola "Sreten Mladenović Mika", Ниш, Niš, Serbia
- IES LAS ESPEÑETAS, Orihuela, Spain
- Colégio Internato dos Carvalhos, Vila Nova de Gaia, Portugal
- Zespół Szkół Ogólnokształcących Nr 17 Specjalnych, Kielce, Poland
- Osnovna škola "Sreten Mladenović Mika", Ниш / Niš, Serbia
- Средно общообразователно училище"Христо Смирненски", Hisarya, Bulgaria
- 1o Gimnasio Kerkiras, CORFU, Greece
- Şirinevler İmam Hatip Ortaokulu, Bursa Turkey
- Zmaj Jova Jovanović", Рума, Ruma, Serbia
- Colegiul Tehnic ,,Mihai Viteazu" Vulcan, Vulcan, Romania
- Eugena Kumičića, Slatina, Croatia
- "Aldini-Valeriani-Sirani", Bologna (BO), Italy
- Réttarholtsskóli, Reykjavík, Iceland

3.2 Working Plan

The project was separated into phases such as deciding the game to create, preparing storyboard (visual template) of the game, identifying characters and roles, coding and sharing.

The working schedule of project was as stated below:

1st Phase

- Students met with other partners. The students were divided into small groups for game design. In this phase, the students used Twinspace, Edmodo and scratch.mit.edu and emails to share their ideas.

2nd Phase

- The student groups decided what game to make.

- After the games were divided into small parts and key ideas, key ideas were ordered and organized for creating the game model.
- All small groups prepared a storyboard[1] for each stage of the game by drawing a square and create the sketch of each stage (visual template).
- Groups shared their storyboards on Edmodo and they got feedbacks from other partners. Groups edited their works according to feedbacks.

3rd Phase

- The students determined how many characters would be in their games and determined the roles of the characters.
- The students decided what would happen when the user wins or lose the game.
- Storyboard and codes were brought together. The characters to be coded in Scratch program were added and they were coded. Then students created coding cards indicating the coding they used for programming characters.
- Students shared their coding cards with other partners.

4th Phase

- Students loaded their characters and codes and created their games using Scratch.
- Then they shared their works on web page (scratch.mit.edu). The links of work are shared on twinspace (http://twinspace.etwinning.net/9236/home).
- At the end of the project a contest was held for best works.

In each phase of the project, project partners shared their products and got feedbacks from other partners using Web 2.0 technologies. Twinspace and Edmodo was used these purposes in scope of the project.

3.3. Tools Used in the Study

Scratch program was used to create games in scope of the research. Etwinning platform and Edmodo website were used for communication and cooperation between partners and sharing the works. A group was created on Edmodo for the study and all participants were enlisted to this group. The participants shared their works on Edmodo platform and given the opportunity to comment on and discuss the works of the partners. Doodle tool was used for scheduling of the works. A screenshot of meeting schedule in Doodle tool can be seen in the Figure 4.

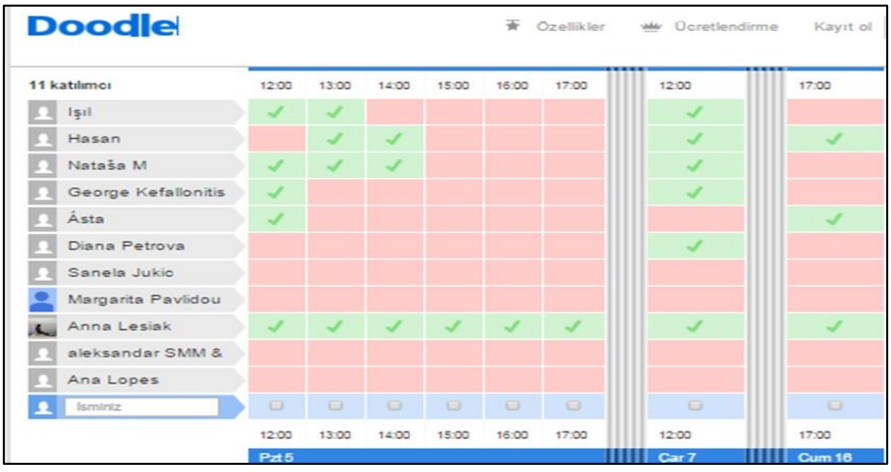

Figure 4 Planning meeting schedule on Doodle tool

3.3.1. Twinspace

Twinspace was used for communicating with partners and creating a common project page during the study. The project page created on Twinspace is given in Figure 5.

1 Storyboard, is a method that helps teaching programming by using graphic design. Every storyboard is a Picture that shows developments of story (Yang 2013). For teaching programming teachers can use storyboard before logics of programming (Klassen 2006).

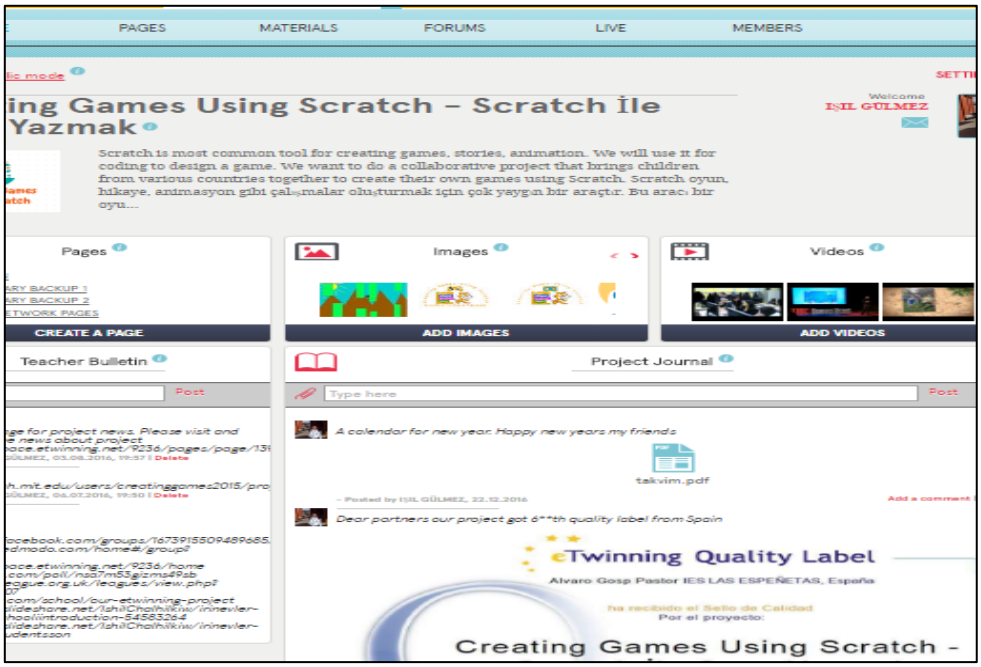

Figure 5 Screenshot of the project Twinspace page

In twinspace, separate pages created and pictures, videos and files of project work was shared. Through Twinspace project partners could communicate and cooperate for the work.

3.3.2. Edmodo

Edmodo is a web 2.0 tool which was used for communication and cooperation of partners in the project. A group was created in Edmodo (see in Figure 6) and partners were invited to the group.

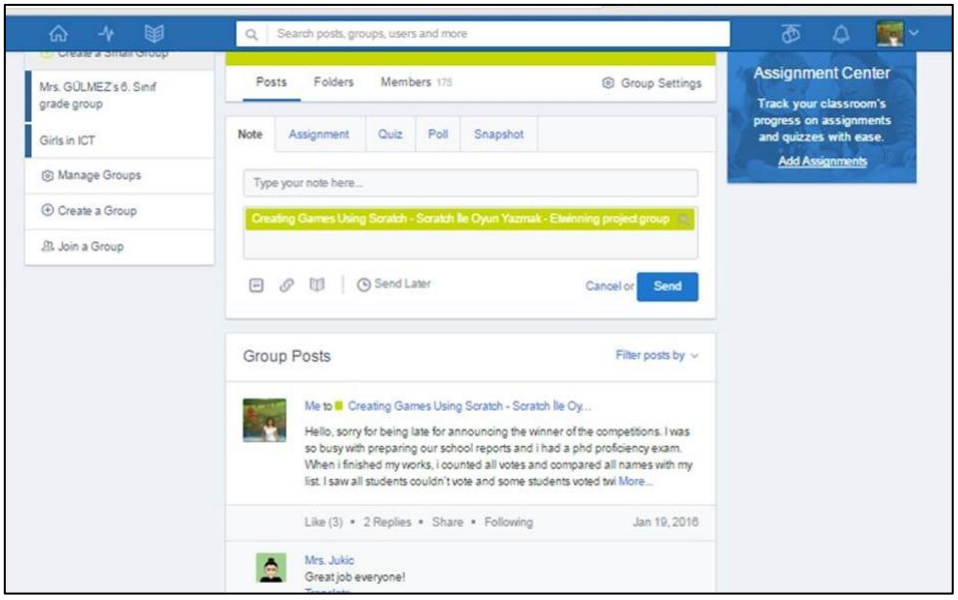

Figure 6 Screenshot of Edmodo group page of project

Project partners shared the works, got feedbacks from other partners and examined the works of others and commented on them on Edmodo. Partner teachers could give digital badges to the students after observing the progress of the students on Edmodo platform. Progress table of students can be seen in Figure 7.

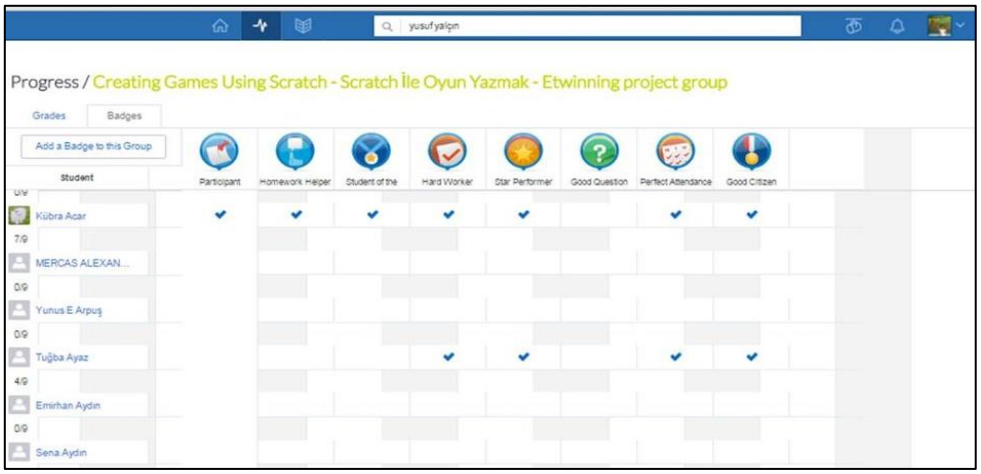

Figure 7 Student Progress Table

In the first phase of the project, teachers asked students how a good computer game should be. Then students in groups decided the game wanted to make. Afterwards students divided the game they designed into small partitions. All groups prepared a storyboard explaining what happened on the stage after creating sketch of each stage in a square (visual template). Then students presented their works to their classmates. The presentations of storyboards of students were given in Figure 8.

Figure 8 Presentation of Storyboards of Students to their Classmates in scope of the Project

The storyboards were shared on Edmodo platform and feedbacks were derived from other partners and adjustments were made depending on the feedbacks. On the 3rd phase of the project, the students decided how many number of characters would be in their games and determined the roles of the characters. The students decided what would happen when the gamer wins or lose the game on this phase. The students drew characters that they designed on Scratch. They coded their characters using drag and drop coding blocks to realize the roles of characters. All partners in the project brought the character and coding cards together with Google Docs[2] and created ebook of coding cards of the games in the project. Then they published their works on http://publizr.com/school/our-etwinning-project?html=true#/154/.
As a result of these project, the students created their own games. The games created by the students are seen in the Figure 9

2 Google Docs is a well-known suite of online collaborative tools for document processing, spreadsheets, online presentations, drawing and even quizzes (Alier Forment, et al. 2013).

The games developed by students (See Figure 9, Figure 10, Figure 11) were shared on Scratch project web page (https://scratch.mit.edu/users/creatinggames2015/projects).

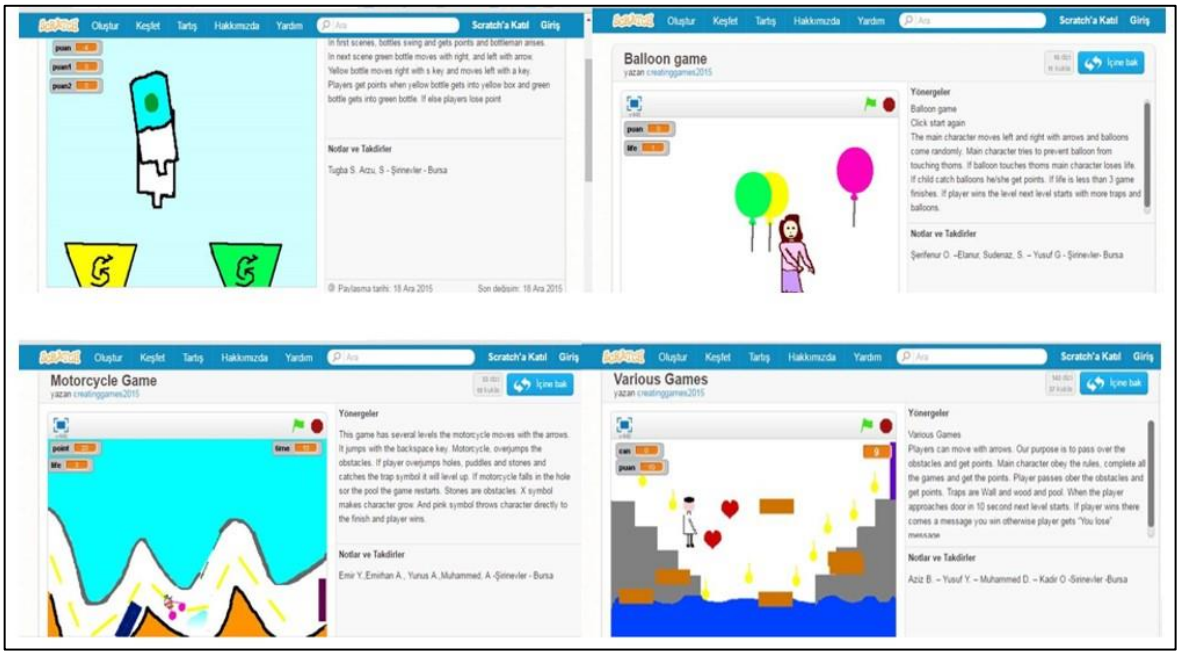

Figure 9 Screenshot of games developed by students in the Project

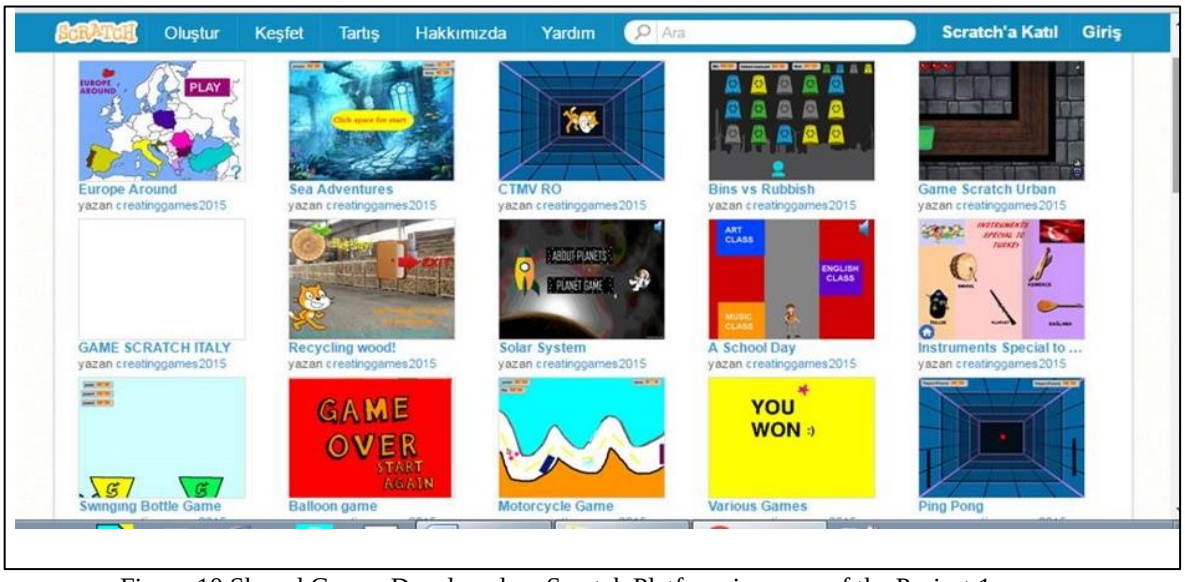

Figure 10 Shared Games Developed on Scratch Platform in scope of the Project 1

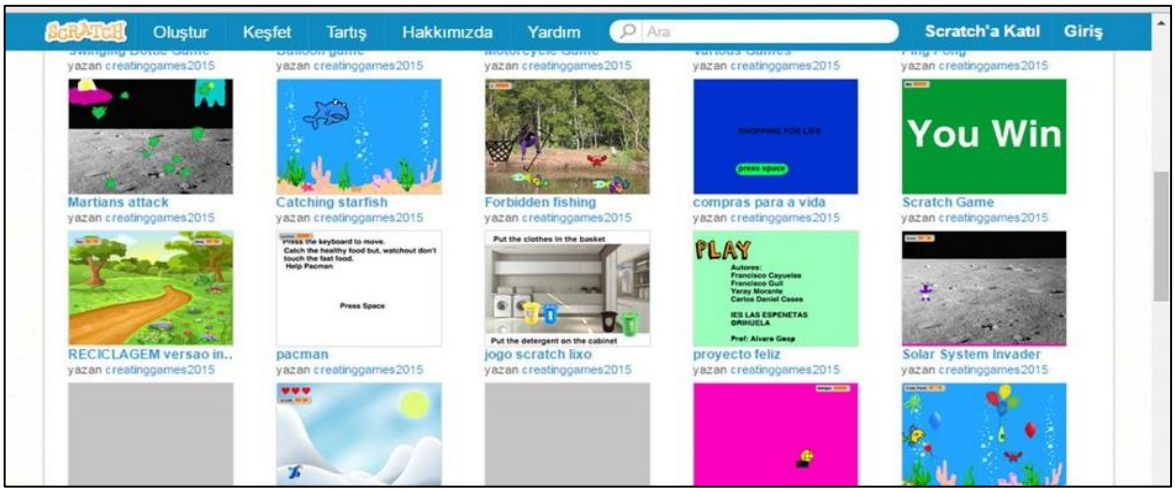

Figure 11 Shared Games Developed on Scratch Platform in scope of the Project 2

The links of the works were also shared on Edmodo group of the project and twinspace address (http://twinspace.etwinning.net/9236/home). At the end of the project a contest for the best work was held as a motivating factor. Patton (2012) emphasizes the importance of exhibiton of the work for evaluation at the end of the projects.

In the research, all participant groups were requested to add the links of their last products and to vote on game they liked the most with tricider voting tool. All participants voted through tricider links(See Figure 12). The result of the contest was announced to all partners.

Figure 12 Link for voting on works conducted at the end of the project

At the end of the project, our project was awarded with 6 National Quality Label Awards from Turkey, Italia, Iceland, Portugal, Serbia and Spain and 5 Europe Quality Label Awards from Turkey, Italia, Iceland, Portugal, Serbia (see Figure 13). In scope of the project, all teachers and students received certificates in regards to national and Europe Quality Labels.

Figure 13 European Quality Label of our Project

4. Limitations

The study was limited with schools participating the project. Resources accessible in the literature were used.

5. Findings and Discussions

At the end of the study, an ebook of the works conducted by partners were. With an interview all partners were asked for their opinions how did they described overall project. Data were gathered and analyzed. Following themes, were generated from interviews with techers in the project: creative, motivating and interesting. A teacher expressed that it was a good project ensuring students to share their experience in writing a game. This result complies with the results of Kearney and Gras-Velázquez (2015) indicating that projects have an effect to increase the motivation of the teachers and interesting the students into learning.

When students were asked to describe the project, most of the students stated that through this project they learned to cooperate with groups. Some of the opinions of students are given below:

Participant 1: Collaborating with groups was very useful, pleasant, and informative because my friends were helpful.

Participant 2: It is useful collaborating with friends but some friends have some mistakes.

Participant 3: Working with groups enables us to come together and have common ideas and do better things. I think working with computer and Internet increased my creativity. In addition, it increased my logical thinking and I enjoyed this work. I was doubtful at first but my self-confidence increased and I shared very good ideas.

All participant students stated that they loved working in groups. The students stated that they considered the project as an opportunity to work together, communicate, share, see their mistakes. Most of students stated that the collaboration in scope of the project was very informing and their horizons widened thanks to the project. These findings of the study support the research results indicating that allowing to work cooperatively motivates the students (Beck and Wade 2004) and affects the learning attitudes of students positively (Blumenfeld et al. 1991; Grant and Branch 2005; Levine 2002; Littky and Grabelle 2004; Newell 2003; Thomas et al. 2005). Since PBL changes the attitudes of students over learning and school life, it is accepted as an approach motivating the students and developing the schools. In addition, the students receiving feedback from their classmates and learn from the feedbacks supports the research results of Peppler and Kafai (2007) regarding detailed effect of *Scratch* over informal learning.

The results of study in regard to participating students are being informed regarding new cultures, working with new web 2.0 tools and learning with classmates. The students cooperated for the project they want to developed under guidance of the teachers and learned about solution methods by separating the problems in basic parts and communicating. Additionally, the students learned how to communicate with classmates in different countries and widened their perspectives regarding education. These skills have significant value in the modern world.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.
Informed consent: Informed consent was obtained from all individual participants included in the study.

References

Anderson, P. (2007). What is Web 2.0? Ideas, technologies and implications for education. Technical report, JISC. Retrieved from: www.jisc.ac.uk/media/documents/techwatch/tsw0701b.pdf

Balanskat, A. & Engelhardt, K. (2014). Computing our future Computer programming and coding - Priorities, school curricula and initiatives across Europe 2014. European Schoolnet (EUN Partnership AISBL) Brussels, Belgium.

Beck, J. C., & Wade, M. (2004). *Got game: How the gamer generation is reshaping business forever*. Boston: Harvard Business School Press.

BIE (2017). What is PBL (PBL)?. Retrieved September 17, 2017 from https://www.bie.org/about/what_pbl

Boss, S. & Krauss, J. (2007). Reinventing project-based learning: Your field guide to real-world projects in the digital age. Washington, DC: *International Society for Technology in Education.*

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palinscar, A.(1991). Motivating project-based learning: Sustaining the doing, supporting the learning. Educational Psychologist, 26(3 & 4), 369-398.

Cassells, D., Gilleran, A., Morvan, C. & Scimeca, S. (2015). *Etwinning Kuşağı.* eTwinning Merkezi Destek Servisi. ISBN: 9789492414229.

Cassells, Gilleran, Morvan & Scimeca (2016). *Growing Digital Citizens: developing active citizenship through eTwinning.* eTwinning Central Support Service. Brussels, Belgium ISBN: 9789492414700.

Chard, S. C. (2011). The project approach. Retrieved January 1, 2018, from http://www.projectapproach.org/project_approach.php

CIBER & Emerald Group Publishing (2010). *Social media and research workflow*. Retrieved February 18, 2013, from: http://ciber-research.eu/download/20101111-social-media-report.pdf

Çıbık, A.S. (2009). The effect of the PBL approach to the attitudes of students towards science lesson. *Elementary Education Online 8*(1), 36-47.

Demirer, V. & Sak, N. (2016). Programming education and new approaches around the world and in Turkey. *Journal of Theory and Practice in Education 12(*3), ISSN: 1304-9496.

Erol, O. et.al. (2012). A New Media for Education: Twitter. *Anadolu journal of Education science international.*

European Union (2015). *Erasmus+ A practical guide for school leaders.* Luxembourg: Publications Office of the European Union, 2015. ISBN 978-92 79-44114-1 doi:10.2766/920245 http://www.schooleducationgateway.eu/en/pub/resources/guide_for_school_leaders2.htm

Fox, T.G. (2013). *PBL in primary grades.* Master thesis. Arts in Education, Northern Michigan University.

Frank, M. & Barzilal, A. (2002). Integrating alternative assessment in a project-based learning course for pre-service science and technology teachers. Paper presented at the learning communities and assessments cultures conference University of Northumbria.

Gilleran, A. & Kearney, C. (2014). *eTwinning aracılığıyla öğrenci yetkinliklerinin geliştirilmesi.* eTwinning Merkezi Destek Servisi. www.etwinning.net

Giouroglou, H. (2011). Education For Sustainability and active citizenship in the EFL classroom. *EDEN Open Classroom 2011 Conference 27-29 October 2011* Athens, Greece.

Grant, M.M. (2002). Getting a grip on Project-based learning: theory, cases and recommendation. Meridian: *A Middle School Computer Technologies Journal* 5(1), ISSN: 10979778.

Grant, M. & Branch, R. (2005). Project-based learning in a middle school: tracing abilities through the artifacts of learning. Journal of Research on Technology in Education, 38(1), 65–98.

Grant, M. (2011). Learning, beliefs, and products: Students' perspectives with project-based learning. *Interdisciplinary Journal of Problem-Based Learning* 5(2), 37-69. Available at: http://dx.doi.org/10.7771/1541-5015.1254.

Halvorsen, A., Duke, N. K., Brugar, K. A., Block, M. K., Strachan, S. L., Berka, M. B., & Brown, J. M. (2012). Narrowing the achievement gap in second-grade social studies and content area literacy: The promise of a project-based approach. Theory and Research in Social Education, 40, 198-229.

Harris, J. H., & Katz, L. G. (2001). Young investigators: The Project approach in the early years. New York.

Harris, M. J. (2014). The challenges of implementing PBL in middle schools. Phd Thesis. University of Pittsburgh.

Intel Teach Program (2007). *Designing effective projects: Characteristics of projects - Benefits of project-based learning.* Intel Corporation. Retrieved from: http://www.intel.my/content/www/my/en/education/k12/project-design/design/project-characteristics.html

Jackson, S. (February 2012). Project-based learning. Scholastic Education. Retrieved from: http://www.scholastic.ca/education/teaching_tip/february2012.html

Kearney, C. & Gras-Velázquez, À. (2015). *eTwinning Ten Years On: Impact on teachers' practice, skills, and professional development opportunities, as reported by eTwinners*. Central Support Service of eTwinning. Brussels, Belgium.

Klassen, M. (2006). Visual Approach for Teaching Programming Concepts. *9th International Conference on Engineering Education.* http://public.clunet.edu//~mklassen/ICEE2006.pdf

Krauss, J. & Boss, S. (2013). *Thinking through projects: Guiding deeper inquiry through project-based learning*. Thousand Oaks, CA: Corwin Press.

Krishnan, S. (2011). Project-based learning with international collaboration for training biomedical engineer. 33rd Annual International Conference of the IEEE EMBS Boston, Massachusetts USA, August – September.

Laboy-Rush, D. (2011*Whitepaper: Integrated STEM Education through Project-Based Learning.* Retrieved August 31, 2016, from http://www.rondout.k12.ny.us/common/pages/DisplayFile.aspx?itemId=16466975.

Larmer, J. & Mergendoller, J.R. (2010). Seven essentials for project-based learning. *Educational Leadership* 68(1), 34-37. Retrieved from:

http://www.ascd.org/publications/educational_leadership/sept10/vol68/num01/Seven_Essentials_for_Project-Based_Learning.aspx

Leigh T. Ausband & Klaudia Schultheis (2010) Utilizing Web 2.0 to Provide an International Experience for Pre-Service Elementary Education Teachers—The IPC Project, Computers in the Schools, 27:3-4, 266-287, DOI: 10.1080/07380569.2010.523886.

Levine, E. (2002) One Kid at a Time: Big Lessons from a Small School. New York: Teachers College Press.

Liebtag, E. & Vander, T. (2016). Preparing teachers for a project-based World. Getting Smart.

Littky, D. & Grabelle, S. (2004) The Big Picture: Education is Everyone's Business. Alexandria, VA: Association for Supervision and Curriculum Development.

Liu, M., Hisao, Y-P. (2002). Middle School Students as Multimedia Designers: A Project-Based Learning Approach. Journal of Interactive Learning Research 13(4).

Malan DJ, Leitner HH. Scratch for budding computer scientists. ACM SIGCSE Bulletin, 2007; 39(1).

Markham, T. & Larmer, J. (2003). PBL Handbook: A Guide to Standards-Focused PBL for Middle and High School Teachers 2nd Rev. BIE (Buck Institue for Education).

Markham, T. (2011). Project-based learning: A bridge just far enough. *Teacher Librarian 39*(2), 39-42.

Mckim, Kerrie. Edmodo and the flipped language class: bridging the gap in language learning. International Conference ICT for Language Learning.

Meyer, Kimberly Ann, "Students' Perceptions of Life Skill Development in Project-Based Learning Schools" (2015). All Theses, Dissertations, and Other Capstone Projects. Paper 509.

Miller, A. (2011). How to refine driving questions for effective project-based learning. Edutopia. Retrieved from: http://www.edutopia.org/blog/pbl-how-to-refine-driving-questions-andrew-miller

Morgan, J. R., Capraro, M. M., & Capraro, R. M. (2013). STEM Project-based Learning : An Integrated Science, Technology, Engineering, and Mathematics (STEM) Approach. Rotterdam: Sense Publishers.

Newell, R. (2003) Passion for Learning: How Project-based Learning Meets the Needs of 21st-century Students. Lanham, MD: The Scarecrow Press.

Patton, A. (2012). Work that matters: The teacher's guide to project-based learning: A High Tech High and Learning Futures Project guide. The Paul Hamlyn Foundation. Retrieved from: http://www.innovationunit.org/sites/default/files/Teacher's%20Guide%20to%20Project-based%20Learning.pdf

Peppler, K. A., & Kafai, Y. (2007). From SuperGoo to Scratch: exploring creative digital media production in informal learning. Learning, media and technology, 32(2), 149- 166.

Pinho-Lopes, M. & Macedo, J. (2014). Project-Based Learning to Promote High Order Thinking and Problem Solving Skills in Geotechnical Courses. International Journal of Engineering Pedagogy. eISSN: 2192-4880.

Railsback, J. (2002). Project-based instruction: Creating excitement for learning. Portland, OR: Northwest Regional Educational Laboratory. Retrieved from: http://educationnorthwest.org/webfm_send/460

Resnick, M. (2009). Scratch programming for all. Communications of the ACM, 52(11), 60.

Robertson, J. (2012). Exploring an archeology of ideas in project-based learning. Available online at http://joannerobertson.wordpress.com.

Rogers, T. (2014). Overcoming implementation challenges with problem and PBL in advanced technological educational programmed within community colleges. Doctoral Thesis. College of Professional Studies. Northeastearn, Boston.

Spires, H.A., Lee, J.K. and Lester, J. (2008). The Twenty-First Century Learner and Game-Based Learning. *Meridian Middle School Computer Technologies Journal 11*(1).

Thomas, J.W. (2000). A review of research on project-based learning. San Rafael, CA: Autodesk.

Thomas, D., Enloe, W. & Newell, R. (2005) The Coolest School in America. Lanham, MD: Scarecrow Education.

Velea, S. (2012). Transnational School Partnerships Supported By Ict. Benefits For Learning. *The 8th International Scientific Conference eLearning and software for Education Bucharest*, April 26-27, 2012 10.5682/2066-026X-12-061.

Vidergor, C. & Harris, R. (2015). Applied Practice for Educators of Gifted and Able Learners. Sense Publishers.

Végh, V., Nagy, Z.B., Zsigmond, C. & Elbert, G. (2017). The effects of using Edmodo in biology education on students' attitudes towards biology and ICT. *Problems Of Education In The 21st Century 75*(5).

White, C.M. (2012). Social Media, Crisis Communication, And Emergency Management. CRC Press Taylor & Francis Group, Sound Parkway NW.

Wrigley, H. (1998). Knowledge in action: The promise of project-based learning. Focus on Basics: Connecting Research and Practice, 2(D). National Centre for the Study of Adult Learning and Literacy. Retrieved from: http://www.ncsall.net/index.html@id=384.html

Wurdinger, S., Haar, J., Hugg, R., & Bezon, J. (2007). A qualitative study using project-based learning in a mainstream middle school. *Improving Schools 10*(2), 150-161. doi:10.1177/1365480207078048 A_qualitative_study_using_project-based_learning_i.pdf

Yang, J. (2013). Teach programming to visual learners. *International Journal Of Information Technology & Computer Science 10* (3).

Yusof, A.M., Daniel, E.G.S., Low, W.Y. & Aziz, K. (2015). eProjBL for special educatİon: a preliminary case study in a Malaysian prİmary school. International Conference on Special Education 2015.

Zheng, J. (2017). Teaching Business Translation—A Project-based Approach. Advances in Economics, Business and Management Research, volume 21.