

## Integration of Project Management in Project Based Learning

Ömer Uysal

Faculty of Education  
Computer and Instructional Technologies Education  
Anadolu University  
Eskisehir, Turkey  
*e-mail: ouysal@anadolu.edu.tr*

Samson Den Lepcha

College of Information  
Learning Technologies  
University of North Texas  
Denton, Texas, USA  
*e-mail: SamsonLepcha@my.unt.edu*

**Abstract**—In the learning environment including schools and university training centers, the most important thing is that learners must accomplish the learning outcomes. In order to do that teachers or mentors design many activities. These activities should engage learners and increase learner motivations. Learners should be challenged with real-life problems to gain real experience. Experts of education suggest that teachers as facilitators should carry out project based learning (PBL) to provide such an active and engaging learning environment. Especially, developed countries apply project-based learning because of the importance and effectiveness of the method. In the literature, notably many researches have proved effectiveness and utility of the PBL. Students enjoy working on a project because they may select the kind of project that they would like to do. While they are working on a project they must collaborate, communicate and solve problems. They also need to be creative and critical thinkers. All such characters belong to the 21st century skillset. That means students can achieve 21st century skills when they engage in a project. PBL is in accordance with constructivist and connectivist approaches to encourage students to be more engaged and organize cognitive structures individually with the help of society and learning environment. In the learning environment many teachers use project-based learning without explaining how to manage project professionally. Some of the projects don't get completed on time, on budget and within the scope because of the lack of project management skills. So, experts must integrate project management in project-based learning. As a result of the integration of PM in PBL, the learners will be able to complete their projects on time, on budget and within scope. Also students will be able to acquire 21st century skills and achieve learning outcome of a course. In this paper the aim is to explain how to integrate project management in project-based learning and to introduce a sample curriculum that was developed for such integration. In this paper, a real time implementation process illustrates the integration process. At the end of the integration of the curriculum of PM in PBL all learners were able to complete their projects on time and within scope while working in a group. One of the teams got first place in the National Challenge in all Texas Region in the U.S.A. after implementing project management skills in project based learning. This proves that the method works.

**Keywords**-*integration, project-based learning, project management, project-based competition.*

\*\*\*\*\*

### I. INTRODUCTION

Education is the most crucial factor to keep existence of a country, to develop, to get better. Developed countries give big importance for education as a national policy. Education consists of essential components such as teacher, curriculum, learning environment and educational management. Therefore, all the components especially educational techniques and methods must be improved in order to increase the quality of the education [1]. One of the methods is project based learning (PBL) to enhance education. Internet is an integral part of our life [2]. PBL can be carried out more effectively and more efficiently with using internet.

In all the learning environment including schools and university training centers, the most important thing is that learners must accomplish the learning outcomes. In order to do that teachers and mentors design many learning activities. These activities should engage learners and increase learner's motivations. Learners should involve in real-life problems to gain real experience through real life. Experts of education recommend to implement project based learning (PBL) to provide an active and engaging learning environment. Constructivist and connectivist approaches recommend that students must be active. Students are active and interactive when they are involved in a project. Especially developed countries apply project-based learning because of the

importance and effectiveness of the method. The research on PBL reports positive outcomes related to student learning in the areas of content knowledge, collaborative skills, engagement and motivation, critical thinking, creativity and problem-solving skills [8,25,28,43,47,48].

Project-based learning is a method that engages students in active learning than in a traditional method. They learn from real-life implementations and they gain real life experience. PBL captures student attentions and provide motivation. PBL help teachers to prepare students for successful lives (ref?). Most of the developed countries have adopted project-based learning and they have used different regional competitions to achieve PBL. Some of the popular programs that integrate PBL are Robotics, Underwater Robotics, Model Rocketry, and Innovative App Challenge. Students should learn how to conduct project. So, students must learn project management (PM).

In this study, PBL project is a Verizon Innovative App challenge. In this article PBL, Verizon App Challenge and PM are described before explaining integration of PM and PBL. The purpose of the study is to integrate PBL and PM together by preparing for the Verizon App Challenge. Project management was integrated in this App project to assist students to manage their projects more professionally and to complete their projects within scope, on time and on budget.

Without knowing how to manage a project, students will have difficulty in planning and executing their projects. As a result of these deficiencies teachers have difficulties implementing PBL more effectively. However, integrating PM in PBL could help teachers in guiding students and helping them execute their projects more effectively.

## II. PROJECT BASED LEARNING

### A. Definitions of PBL

Project-based learning is an effective and an attractive method for both learning and teaching. The literature reveals several different definitions for PBL. All definitions represent one or more features of PBL. According to Buck Institute for Education (BIE), PBL is a systematic teaching method that engage students in learning important knowledge and 21st century skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed products and learning tasks[18].

In PBL, students face a challenging task, and their designs, problem-solving, decision-making, and research allow them to autonomously conduct work related to the topic during a period of time, completing a real product [43]. PBL is a teaching method that uses “projects” to organize the curriculum. Students learn important academic content through well-designed projects by investigating questions, generating and evaluating solutions and producing products that demonstrate what they have learned [6].

According to Ronald Marx et. al. [31] project-based instruction often has a ‘driving question’ encompassing worthwhile content that is anchored in a real-world problem; investigations and artifacts that allow students to learn concepts, apply information, and represent knowledge in a variety of ways; collaboration among students, teachers, and others in the community so that participants can learn from one another; and use of cognitive tools that help learners represent ideas by using technology.

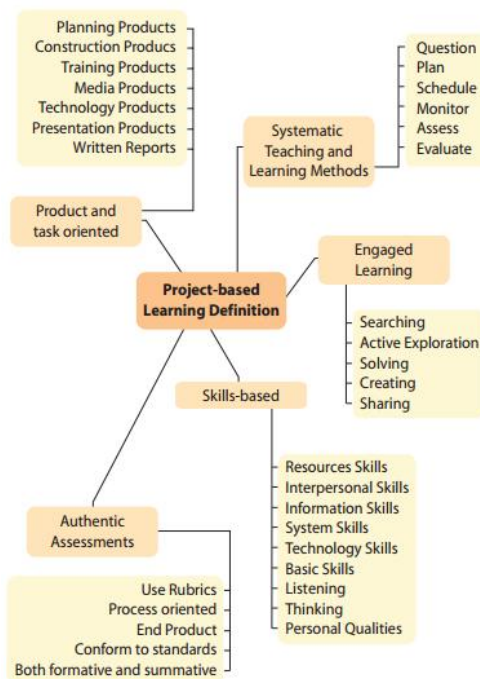


Figure 1. Classification of project based learning definitions

As it is seen above there are various definitions about PBL in the literature. Figure 1 shows classification of these definitions in terms of product, learning methods, engaged learning, skills-based, authentic assessments [11].

### B. Characteristics and Design Principles of PBL

Usually, Information Communication Technologies (ICT) are used for PBL such as other learning methods. When PBL is supported by Information Communication Technologies (ICT), nine general desirable characteristics of a PBL can be described as below[25,32,43]:

1. They are learner-centered.
2. They have authentic content and purpose.
3. They are challenging.
4. They involve the design and development of a product, presentation, or performance.
5. They require collaboration and cooperative learning.
6. They allow incremental and continual improvement.
7. They are teacher-facilitated.
8. They have explicit educational goals.
9. They are rooted in constructivism.

There are different PBL design principles in the related literature[9,16,27,35,40,43]. Experts suggest that PBL activities are carried out effectively and successfully with these design principles. So, teachers must take into consideration these principles carrying out PBL. BIE identified Gold Standard of PBL. According to BIE, Essential Project Design Elements include certain features shown below [29]:

- **Key Knowledge, Understanding, and Success Skills:** The project is focused on student learning goals, including standards-based content and skills such as critical thinking/problem solving, collaboration, and self-management.
- **Challenging Problem or Question:** The project is framed by a meaningful problem to solve or a question to answer, at the appropriate level of challenge.
- **Sustained Inquiry:** Students engage in a rigorous, extended process of asking questions, finding resources, and applying information.
- **Authenticity:** The project features real-world context, tasks and tools, quality standards, or impact – or speaks to students’ personal concerns, interests, and issues in their lives.
- **Student Voice & Choice:** Students make some decisions about the project, including how they work and what they create.
- **Reflection:** Students and teachers reflect on learning, the effectiveness of their inquiry and project activities, the quality of student work, obstacles and how to overcome them.
- **Critique & Revision:** Students give, receive, and use feedback to improve their process and products.

- Public Product: Students make their project work public by explaining, displaying and/or presenting it to people beyond the classroom.

### C. Why Project Based Learning (PBL)?

Project Based Learning's time has come. The experience of thousands of teachers across all grade levels and subject areas, backed by research, confirms that PBL is an effective and enjoyable way to learn - and develop deeper learning competencies required for success in college, career, and civic life (BIE, 2016). Why are so many educators across the United States and around the world interested in this teaching method? The answer is a combination of timeless reasons and recent developments.

- PBL makes school more engaging for students.
- PBL improves learning.
- PBL builds success skills for college, career, and life.
- PBL helps address standards.
- PBL provides opportunities for students to use technology.
- PBL makes teaching more enjoyable and rewarding.
- PBL connects students and schools with communities and the real world.

PBL consists of different educational methods such as inquiry based learning, cooperative learning, problem solving, problem based learning, team based learning, deep learning, research based learning[5,32].

### D. PBL Process Steps

There are different process steps regarding PBL. Diffily and Sassman [10] stated that four major steps in PBL are selecting the topic to study, planning the project, implementing plans for the project and choosing and creating an end product that shares knowledge with other people.

According to Blumenfeld et al. [3], project-based learning has these process steps, but is not limited: • Asking and refining questions • Debating ideas • Making predictions • Designing plans and/or experiments • Collecting and analyzing data • Drawing conclusions • Communicating ideas and findings to others • Asking new questions • Creating artifacts

Stix and Hrbek[41] stated that there are nine process steps for project-based learning (of course, teacher-coaches should modify the steps accordingly to suit the task and the students):

1. The teacher-coach sets the stage for students with real-life samples of the projects they will be doing.
2. Students take on the role of project designers, possibly establishing a forum for display or competition.
3. Students discuss and accumulate the background information needed for their designs.
4. The teacher-coach and students negotiate the criteria for evaluating the projects.
5. Students accumulate the materials necessary for the project.
6. Students create their projects.
7. Students prepare to present their projects.
8. Students present their projects.
9. Students reflect on the process and evaluate the projects based on the criteria established in Step 4.

According to Erdem and Akkoyunlu[13], the basic process steps for PBL are:

1. Stating objectives.
2. Describing and defining of the problem or issue
3. Identifying features of final report and delivery format
4. Identifying of evaluation criteria and competence level
5. Forming Teams
6. Identifying questions and planning for data collection.
7. Preparing a time schedule.
8. Determining checkpoints.
9. Collecting related information.
10. Organizing the information and writing project report.
11. Giving a presentation about project.
12. Evaluation of the projects and student performance.

These process steps are crucial to ensure that project-based learning make learning more rewarding. So teachers must consider process steps to carry out PBL activities to the best advantage. Teachers and mentors should follow the basic process steps for their PBL activities. In PBL, teacher is a coach, a mentor, a guide, a project manager, co-learner and student is a researcher, designer, problem solver, active learner and collaborator.

The world is changing. The job market is changing. Globalization is impacting all of us and changing the way we interact in the work place. The skills needed in today's work place are different than what was needed fifteen or even ten years ago[7]. So experts must develop solutions to address this global issue. PBL is required but not sufficient. The solution is to integrate PBL with PM. Therefore, students can adapt to the changing job market.

## III. PROJECT MANAGEMENT

The world runs on projects – everyday life projects like planning and planting a garden or buying something, school projects like devising and performing experiments for a science fair project, and work-world projects like designing and building a bridge or developing and delivering a community program to reduce energy use[39]. Actually, everyone in the daily life or in the workplace manages projects in the world whether aware of or not. So each of us should learn about professional PM as much as we can.

Project is a temporary effort in creating a product, service or a result [36]. Quality expert Dr. J. M. Juran defines a project as a problem scheduled for solution. This definition forces us to recognize that projects are aimed at solving problems [30]. Projects are a daily part of everyone's lives, from work to homelife to education. PMIEF (2015, p.23) [38] also delineates two key qualities for projects that are useful to keep in mind:

1) Projects are temporary efforts with a clear start and finish – they are not ongoing.

2) Projects have an end result – something created or completed, that is often unique.

The term "project" is used to cover a variety of activities, which can be broken down into four fundamentally different types of inquiry: literature review, information search, empirical research or design [21]. Learners need to know how to manage project in order to overcome a project associated with PBL as it is seen one of the most meaningful learning activities in 21<sup>st</sup> century.

Projects can be integrated into any subject matter and are a natural and effective way to develop important college and career readiness skills, as well as Science, Technology, Engineering, and Math (STEM) skills [37]. The developed countries have applied STEM Education and STEM projects such as Best Robotics, Underwater Robotics, Rocketry, TEAMS, Future City, Verizon Innovative App Challenge etc. In order to make students more productive especially with high added value, different kinds of project competitions are arranged especially for students who will be candidate of big projects in the near future. So what can we do in order to make students successful for not only these kinds of competitions but also for real-life projects? The answer is obvious. They must learn and internalize PM and through practice and execution of several different projects.

Project management is an application of knowledge, skills, tools and techniques to project activities to meet project requirements [36]. According to Lewis [30], project management is the planning, scheduling, and controlling of project activities to meet project objectives. The major objectives that must be met include performance, cost, and time goals, while at the same time you control or maintain the scope of the project at the correct level. Project management includes nine knowledge areas as shown on Figure 2.

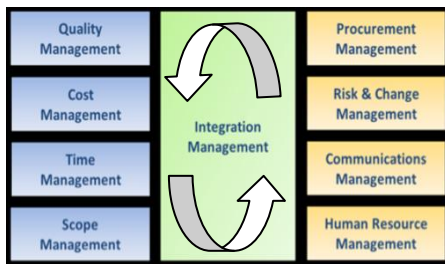


Figure 2. Project management knowledge areas

These all areas must be used for completing project within scope, on time and on budget. According to Boss and Kraus [5] project management helps students manage time, work, sources, feedback from others, drafts and products during projects. There is an important connection between PM skills and 21<sup>st</sup> century skills as it is seen from Table 1.

TABLE 1 CONNECTION BETWEEN PM AND 21<sup>ST</sup> CENTURY SKILLS

PM Skills	21st Century Skills
Communication Management	Communication
Scope Management	Core Subjects
Cost Management	Economic-Financial Literacy
Time Management	Initiative and Self-Direction
Human Resource	Leadership and Responsibility
Procurement Management	Productivity and Accountability
Risk Management	Critical Thinking-Problem Solving
Quality Management	Productivity and Accountability
Integration Management	Leadership and Responsibility

Table 1 shows that PM skills are almost same as 21<sup>st</sup> century skills. P21 [38] also indicates that managing project is a core skill in Life and Career Skills. Managing project contributes to achieve 21<sup>st</sup> century skills as many researches proved it [7,36,37,39].

PM includes five process groups such as initiating, planning, executing, monitoring and controlling and closing [36]. Project managers must complete certain tasks throughout each single process. Lewis [30] identified the steps in managing a project as shown on figure 3. The identification is similar with PMI five process groups.

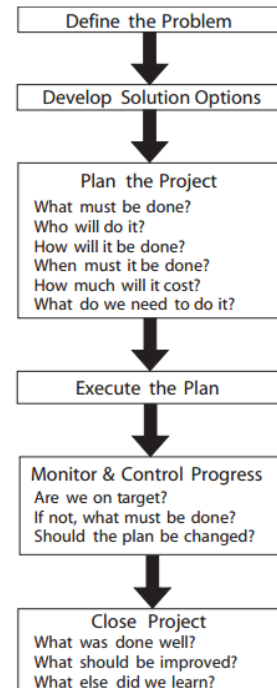


Figure 3. The steps in managing a project

1. Initiating Process Group: Development of an idea and creating a charter to get the project done. Those processes performed to define a new project or a new phase of an existing project by obtaining authorization to start the project [36].

2. Planning Process Group: Development of the scope statement, deliverables, and assumptions for the project [36]. Planning is answering questions-what must be done, by whom, for how much, how, when, and so on [5]. Those processes required to establish the scope of the project, refine the objectives, and define the course of action required to attain the objectives that the project was undertaken to achieve [36].

3. Executing Process Group: Progressive work on the tasks in the project schedule [36]. Once the plan is drafted, it must be implemented [5]. Those processes performed to complete the work defined in the project management plan to satisfy the project specifications [36].

4. Monitoring and Controlling Process Group: Making sure everything in the project happens as it is scheduled with quality and within cost. [36]. Plans are developed so that you can achieve your end result successfully. Unless progress is monitored, you cannot be sure you will succeed [5]. Those processes required to track, review, and regulate the progress

and performance of the project; identify any areas in which changes to the plan are required; and initiate the corresponding changes[36].

5. Closing Process Group: Wrapping up to make sure everything is done in the project [36]. Once the destination has been reached, the project is finished, but there is a final step that should be taken. The point is to learn something from what you just did. Note the way the questions are phrased: What was done well? What should be improved? What else did we learn? We can always improve on what we have done [30]. Those processes performed to finalize all activities across all Project Management Process Groups to formally close the project[36].

Knowledge Areas and Process Groups are essential components of the PM. There are 42 PM processes within the 5 PM process groups and the 9 Knowledge Areas [36].

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
Project Integration Management	• Develop Project Charter	• Develop Project Management Plan	• Direct and Manage Project Execution	• Monitor and Control Project Work • Perform Integrated Change Control	• Close Project or Phase
Project Scope Management		• Collect Requirements • Define Scope • Create WBS		• Verify Scope • Control Scope	
Project Time Management		• Define Activities • Sequence Activities • Estimate Activity Resource • Estimate Activity Duration • Develop Schedule		• Control Schedule	
Project Cost Management		• Estimate Cost • Determine Budget		• Control Costs	
Project Quality Management		• Plan Quality	• Perform Quality Assurance	• Perform Quality Control	
Project Human Resource Management		• Develop Human Resource Plan	• Acquire Project Team • Develop Project Team • Manage Project Team		
Project Communications Management	• Identify Stakeholders	• Plan Communications	• Distribute Information • Manage Stakeholder Expectations	• Report Performance	
Project Risk Management		• Plan Risk Management • Identify Risk • Perform Qualitative Risk Analysis • Perform Quantitative Risk Analysis		• Monitoring and Control Risks	
Project Procurement Management		• Plan Procurement	• Conduct Procurement	• Administer Procurements	• Close Procurements

Figure 4. PM Process Groups and Knowledge Areas Mapping

Whoever wants to complete project within scope, on time and on budget must consider all 42 PM processes. Teachers or mentors must embed all these 42 PM processes in PBL activities with students in order to integrate PM in PBL most correctly. If it is not embedded, then the integration of PM in PBL will fail.

In 21<sup>st</sup> century, one of the objectives of education institutions is that students should achieve professional skills, interpersonal skills and ethical skills. Project management helps develop all those three skills [21,36]. In the schools, project-based learning is emerging as one of the most popular ways to assign homework and build teams. Students usually have to complete some sort of project when they compete in project-based challenges. However, many schools do not teach project management in such projects. As Hoyet points out [22]:

*It is critical for students to learn these working skills early in their academic careers, as many teachers in high school assign group projects without providing training in the skills to work successfully in teams. Learning how to plan task lists, task schedules, and how to manage a complex project are skills that students will use in academic and professional environments.*

Students should develop project management skills before entering the workforce. Therefore, an effort has been made in

this study to explain how to integrate project management into project-based learning.

**Project management framework is optimal for all project-based learning**

Project Management Institute Educational Foundation (PMIEF) focuses on the topic and develop a curriculum for project management. They believe that students who are taught the skills of project management at the early age will be prepared with the knowledge and skills required to meet the demands of the 21st century workforce. Throughout the research, relevant worksheets were given to students to fill them out. When they fill those worksheets they are able to figure out what they must do. Next, they prepared a project proposal step by step in groups. At the end of the course students complete their proposed projects.

The art of project management is crucial in all STEM projects. A strategically implemented project management in such projects will provide a smooth process for students and maximize the outcome of their overall project. A sample of project management integration in STEM project was performed at a secondary school in Texas with the Verizon Innovative App Challenge project.

The Verizon Innovative App Challenge (VIAC) is organized by the Verizon Foundation and administered by Technology Student Association. It is designed to encourage middle school and high school students to work in team under the guidance of a faculty advisor and develop a mobile app concept that addresses a real need or problem in their school or community. The rules for Verizon Innovative App Challenge may differ each year but the deliverables remain the same. This VIAC STEM project is designed to challenge students' innovation while cultivating interest in science, technology, engineering and mathematics.

There are two deliverables in the VIAC: 1) An essay response describing statement of problem, mobile app solution, uniqueness of the mobile app solution and the mobile app feature and 2) A 3-minute video and the presentation addressing the problem and illustrating how the innovative app would resolve the problem. The framework of project management is optimal for all project-based learning programs such as the Verizon Innovative App Challenge.

**IV. METHOD OF INTEGRATING PM WITH PBL**

Any STEM project will require a project plan and management strategies to successfully complete it. One of such project is the aforementioned app challenge project. The yearly Innovative app challenge has an open registration starting the first week of August and the submission deadline on the last week of November.

The challenge has rules clearly defining the purpose, contents, and important dates of the challenge (<http://appchallenge.tsaweb.org/>). However, students are left to tackle the challenge and manage time to successfully accomplish the project without further instruction. Therefore, the mentors for this project first guide students about project management tactics before working on the project deliverables. This process took approximately six weeks to complete. During these six weeks, project management lessons and skills were applied in completing this project by a total of

five teams. A weekly lesson plan was designed and offered to these teams.

In the first week, an overview of the Verizon App Challenge were discussed by reviewing past videos and apps developed by prior teams. The sample app projects from previous years are available on Verizon's website <http://appchallenge.tsaweb.org/>. Each student read the Verizon rules that were posted on Canvas Learning Management System, where all the project course works were posted and assessed. The assignment for the first week was for students to come up with individual App idea and write a summary.

The two-hour daily project was divided by the first hour of instruction session followed by hands-on activities on the second hour. The week 1 included lectures on introduction and different information areas of project management, which were taught using PowerPoint presentations. The hands-on activities for the first week were for students to try out some block coding exercises to get them familiar with coding and programming. The block coding programs from code.org are very student-friendly which introduces students to different concepts of programming. This also directly prepared students for MIT-App Inventor exercises, which was introduced later in the project that creates interactive App for android phones.

TABLE II INTEGRATION OF PM IN PBL WEEK 1

WEEK 1	First Hour	Second Hour
MONDAY	<ul style="list-style-type: none"> <li>Overview of the Verizon App challenge                             <ul style="list-style-type: none"> <li>Review rules in Canvas</li> <li>Review deadlines</li> <li>Review past videos and Apps</li> </ul> </li> </ul>	Individual App concept idea overview and summary writing (Use Overview Rubric)
TUESDAY	<ul style="list-style-type: none"> <li>Project Management (Lecture)                             <ul style="list-style-type: none"> <li>Introduction</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Block coding session code.org                             <ul style="list-style-type: none"> <li>Programming, Algorithm &amp; Sequence</li> </ul> </li> <li>Education Speaker</li> </ul>
WEDNESDAY	<ul style="list-style-type: none"> <li>Project management (Lecture)                             <ul style="list-style-type: none"> <li>9 information areas</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Block coding session code.org                             <ul style="list-style-type: none"> <li>Loops, Debugging, Conditionals</li> </ul> </li> <li>Sustainability Speaker</li> </ul>
THURSDAY	<ul style="list-style-type: none"> <li>Project management (Lecture)                             <ul style="list-style-type: none"> <li>5 Process Groups</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Block coding session code.org                             <ul style="list-style-type: none"> <li>Binary, Big event, Flappy, Digital, footprint, Nested Loops</li> </ul> </li> <li>Healthcare Speaker</li> </ul>
FRIDAY	Individual Presentation of App concept overview	Individual Presentation of App concept overview

The formation of five different teams based on their interest areas started on second week. Based on the individual App idea presentation and interest areas on the first week, teachers carefully assigned students to their respective interest groups. The five groups were: ChronicCare (Health), Safety & Security, Hearing Help, Car Parts and Food Saver. Once the teams were assigned, students worked in their teams to complete several project management essentials.

It was very important for the teams to come to an understanding that they need to work collaboratively with respect and responsibilities. Therefore, a lecture on project management code of ethics was presented along with communication methods for project management. Each team decided how they would conduct amongst themselves and the best way for them to communicate amongst themselves and with their advisors.

In the second week, students completed worksheets such as Project Charter, Project Scope Statement, Communication Matrix and Human Resource Management forms developed by PMIEF [37] from Project Management Toolkit for Youth. The purpose of the worksheet for students were to help them understand different knowledge areas of the project management by implementing them in Verizon App. Challenge. In addition, students divided into sub-groups based

on the three deliverables required by the challenge. These sub-groups were responsible for three deliverables: 1) Writing an overview, 2) Writing an essay, and 3) Preparing visual presentation. The details of these deliverables were outlined in the official rules published by the Verizon Innovative App Challenge on their website.

At the end of the second week, each team met with the teacher-advisors to go over the completed Human Resources Management. This helped teams verify that they were on theright track for the preparation of this challenge.

TABLE III INTEGRATION PM IN PBL WEEK 2

WEEK 2	First Hour	Second Hour
MONDAY	<ul style="list-style-type: none"> <li>Announce 5 project groups</li> <li>Break into groups</li> </ul>	<ul style="list-style-type: none"> <li>Each team finalizes project focus (use decision matrix)</li> <li>Start Project Charter &amp; Scope Statement as a team</li> </ul>
TUESDAY	<ul style="list-style-type: none"> <li>Project Management Code of Ethics (Lecture)</li> <li>Communication Methods for Project Management (Lecture)</li> </ul>	Establish team communication <ul style="list-style-type: none"> <li>Exchange emails, phone numbers, skype, social media, text messaging, t2f, shared drive</li> <li>Complete Communication Matrix as a team</li> </ul>
WEDNESDAY	Each team discuss scope of project	<ul style="list-style-type: none"> <li>Continue Scope Statement</li> </ul>
THURSDAY	<ul style="list-style-type: none"> <li>Continue Scope Statement</li> </ul>	<ul style="list-style-type: none"> <li>Complete Scope Statement</li> </ul>
FRIDAY	Team Member Assignments (skill sets) <ul style="list-style-type: none"> <li>Writing overview</li> <li>Writing essay</li> <li>Preparing visual presentation</li> <li>Use Human Resource Management Form</li> </ul>	Team meets with advisors with completed Human Resource Management Form

The goal of the third week was to breakdown all the project tasks and assign responsible team members to each task. Therefore, it was essential for each team to complete worksheets on Project Work Breakdown Structure, Project Charter, Organization Chart and Responsible Assignment Matrix. In addition, teams also completed a project timeline using Excel sheet. To get students familiar with the programming of App development, MIT App Inventor exercises were conducted in class. These exercises helped students to look at simple Java codes that were essential in creating an interactive App for Androids.

At the end of the week 3 students completed Status Report worksheet that indicated what the team has accomplished including other tasks in progress. A detail worksheet on Risk Management Strategies were written and discussed to make sure that every effort will be made to make this project a success. The risk factors in accomplishing this project were identified and designated team member developed strategies to tackle each risk.

TABLE IV INTEGRATION OF PM IN PBL WEEK 3

WEEK 3	First Hour	Second Hour
MONDAY	<ul style="list-style-type: none"> <li>Project Work Breakdown Structure</li> <li>Build project timeline using Excel</li> </ul>	Start Project Charter as a team
TUESDAY	Complete Organization Chart	Complete Responsibility Assignment Matrix
WEDNESDAY	Complete Risk Management Strategies	MIT App Inventor (Shake It!) MIT App Inventor (Talk To me)
THURSDAY	Complete Project Charter as a team	MIT App Inventor (Ball Bounce)
FRIDAY	MIT App Inventor (Digital Doodle)	Status Report: <ul style="list-style-type: none"> <li>Project Work Breakdown Structure</li> <li>Project Charter</li> <li>Organization Chart</li> <li>Responsibility Assignment Matrix</li> </ul>

In the fourth week, students worked in sub-groups to achieve sub-group tasks: overview, essay and visual presentation. After sub-groups completed their tasks, each group discussed about all sub-group tasks to refine them. In the middle of the week 4, students finished writing the first

draft of their project requirements and started to prepare team presentation. Next, students filled out Status Report and deliver them to teachers. Teachers (sponsors, mentor) gave feedback for first draft of projects.

TABLE V INTEGRATION OF PM IN PBL WEEK 4

WEEK 4	First Hour	Second Hour
MONDAY	Subgroup Tasks: • Overview, Essay, Visual Presentation	Subgroup Tasks: • Overview, Essay, Visual Presentation
TUESDAY	Subgroup Tasks: • Overview, Essay, Visual Presentation	Subgroup Tasks: • Overview, Essay, Visual Presentation
WEDNESDAY	Each team evaluates subgroup tasks	Each team evaluates subgroup tasks <b>First draft of project proposal due</b>
THURSDAY	Design Team Presentation	Design Team Presentation
FRIDAY	• Status Report • Feedback on first draft • Design Team Presentation while waiting for status report	• Status Report • Feedback on first draft • Prepare second draft of Project Proposal

The fifth week marked to be very important for all the teams to complete their projects and present in front a board of panelists for a formal review and feedback. To achieve this, students worked on completing the second draft of project proposal and designed a dynamic team presentation outlining their projects. A board of panelists was strategically selected to give each team formal reviews and feedback before they made official submission of their project to the Verizon. The board of panelists used cloud-based and Google generated presentation and essay rubrics based on Verizon challenge. Each judge had a laptop with an access to these rubrics for them to rate each team's essay and presentation. The input from the judges were collected using the Google survey form which was later used to help students refine their projects based on the collective feedbacks.

TABLE VI INTEGRATION OF PM IN PBL WEEK 5

WEEK 5	First Hour	Second Hour
MONDAY	• Prepare second draft of Project Proposal	• Design Team Presentation
TUESDAY	• Prepare second draft of Project Proposal	• Design Team Presentation
WEDNESDAY	• Practice presentation of proposal (All teams together)	• Practice presentation of proposal (All teams together) <b>Second draft of project proposal due</b>
THURSDAY	<b>Presentation of Proposals to Panelists (POL)</b>	<b>Presentation of Proposals to Panelists (POL)</b>
FRIDAY	• Reviews and feedbacks from panelists • Review second draft • Start finalizing proposal for submission	• Start finalizing proposals for submission • Review second draft • Start finalizing proposal for submission

In the sixth week, students made improvement on project proposals based on the feedback from the panelists in order to finalize project deliverables. Student revised and studied course contents, lecture presentations and other resources about project management for final exam, which assessed their knowledge of project management. Students were asked to self-evaluate project management skills after completing their projects using Google generated survey questionnaires. They also wrote reflection papers and lessons learned. In order to improve future course, students were interviewed for feedback.

TABLE VII INTEGRATION PM IN PBL WEEK 6

WEEK 6	First Hour	Second Hour
MONDAY	• Make improvement on project proposal based on the feedback from the panelists	• Make improvement on project proposal based on the feedback from the panelists
TUESDAY	• Finalize proposal	• Finalize proposal
WEDNESDAY	• Prepare for submission	• Prepare for submission
THURSDAY	• Final exam	• Survey
FRIDAY	• Project Reflection • Lessons learned	• Interviews

## V. CONCLUSION AND DISCUSSION

PBL is the one of the most effective ways that students can achieve educational purposes such as 21st. century skills etc. The short definition of the PBL is doing a project. So if we desire to make PBL effective and successful, learners must learn and internalize how to manage project through project management strategies. As seen on Table 1 there is a clear connection between PM and 21<sup>st</sup> century skills and they are almost the same. As found in the literature review, the following skills can be achieved through PM and PBL [4,7,12,14,17,19,20,22,32,33,35,36,37,39,42,43,46]:

- Problem-solving skills
- Self-directed learning skills
- Ability to work on a team
- Critical thinking, Communication, Collaboration, Creativity
- Social and ethical skills
- Self-sufficient and self-motivated
- Ability to find and use appropriate resources
- ICT skills
- Leadership skills
- Time management
- Cost management
- Lifelong learning and learning to learn skills etc.

Learning outcomes of the course as a result of integration PM in PBL throughout VIAC are briefly stated as below:

- Project-based Learning (Primary goal of PBL is to integrate learning with hands-on lessons while solving problems that are real)
  - Achievements from this project in particular to PBL are:
    - Students identified the problems in the school and community
    - Brainstormed solutions for the problems identified
    - Designed and developed solutions
    - Explained features with visual presentation
    - Give a public speech
    - Prepared all the deliverables
- PM developed / enhanced students' professional, interpersonal and ethical skills.
- Successful completion of project
  - Each team delivered visual presentation
  - Each team completed essay
  - Each team presented in front of the judges, panelist and public
  - Official submission of visual presentation and essay

PBL is still quite new methodology for most of the European universities. It seems interesting and attractive not only for the students, but for the teachers and private companies as well [48]. If the learners can acquire 21<sup>st</sup> century through proper integration of PM and PBL, all the schools and universities throughout the world would embrace such methodology.

## VI. RECOMMENDATIONS

To carry out an effective PBL, teachers and mentors must learn how to manage project. One of the key factors to meet project requirements is to integrate PM in PBL.

- Invite PM experts in different areas of students' interests.
- Apply project management to other project-based learning activities such as best robotics, underwater robotics, model rocketry, TEAMS, future city etc.
- Organize different kinds of competitions that students can take part with their projects

Students must learn to manage budget. It is difficult for schools to provide large amount of budget for a project. However, one may design special project competition under \$100 budget.

Tripathi and Goyal [44] suggest that projects transform from traditional to agile. In agile project management, projects focus on customer expectations, meet customer needs and increase the customer satisfactions. Learners are customers in Education System. Learning must be learner centered. PBL is the one of the learner-centered method. In order to increase the quality of the PBL we should integrate PM in PBL. Therefore learners can get maximum benefits from such learning process.

## REFERENCES

- [1] Ari, E., Yilmaz, V. (2015a). Hopelessness Levels of Teachers Who Follow KPSS Preparation Courses. *Gaziantep University Journal of Social Sciences*, 14(4), 905-931.
- [2] Ari, E., Yilmaz, V. (2015b). Investigating The University Students' Online Food Ordering Behaviour By Technology Acceptance Model. *International Journal of Alanya Faculty of Business*, 7(2), 65-84.
- [3] Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist*, 26 (3 & 4), pp. 369-398.
- [4] Boondee, V., Kidrakarn, P. and Sa-Ngiamvibool, W. (2011). A Learning and Teaching Model using Project-Based Learning (PBL) on the Web to Promote Cooperative Learning. *European Journal of Social Sciences – Volume 21, Number 3*, 498-506.
- [5] Boss, S. and Krauss, J. (2007). Re-inventing project-based learning. Washington, DC: ISTE.
- [6] Boss, S., Larmer, J., Mergendoller, J. R. (2013). PBL for 21st century success. Buck Institution for Education, Novato, CA. p.138.
- [7] Byrne, J. J., Snyder, J., & Seward, D. (2008). Project management's future: Teaching project management to high school students using project learning. PMI Global Congress Proceedings, Denver, Colorado, 2008.
- [8] CELL: Center of Excellence and Leadership of Learning in University of Indianapolis. (2009). Summary of Research on Project-based Learning. Retrieved March 18, 2016 from <http://cell.uindy.edu/docs/PBL%20research%20summary.pdf>
- [9] Darling-Hammond, L., & Barron, B., Pearson, P. D., Schoenfeld, A. H., Stage, E. K., Zimmerman, T. D., Cervetti, G. N., & Tilson, J. L. (2008). *Powerful learning: What we know about teaching for understanding*. San Francisco, CA: Jossey-Bass.
- [10] Diffily, D. and Sassman, C. (2002). *Project-based learning with young children*. Portsmouth, NH: Heinemann.
- [11] Educational Technology Division Ministry of Education (2006). *Project-Based Learning Handbook: Educating the Millennial Learner*. Kuala Lumpur, Malaysia: Educational Technology Division Ministry of Education. p.5.
- [12] Erdem, M. (2002). Project based learning. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 22, 172-179.
- [13] Erdem, M and Akkoyunlu, B. (2002). İlköğretim Sosyal Bilgiler Dersi Kapsamında Beşinci Sınıf Öğrencileriyle Yürütülen Ekip Proje Tabanlı Öğrenme Üzerine Bir Çalışma. *İlköğretim Online* 1(1), 2-11
- [14] Fogleman, J., McNeill, K. L., & Krajcik, J. (2011). Examining the effect of teachers' adaptations of a middle school science inquiry-oriented curriculum unit on student learning. *Journal of Research in Science Teaching*, 48(2), 149-169.
- [15] Garrison, D.R.; Kanuka, H. Blended learning: Uncovering its transformative potential in higher education. *Internet High. Educ.* 2004, 7, 95–105.
- [16] Grant, M. M. (2002). Getting a grip on project-based learning: Theory, cases and recommendations. *Meridian: A Middle School Computer Technologies Journal*, 5(1).
- [17] Gültekin, M. (2005). The effect of project based learning on learning outcomes in the 5th grade social studies course in primary education. *Educational Sciences, Theory and Practice*, vol. 5(2), 548-557.
- [18] Hallermann, S., Larmer, J., Mergendoller, J. R. (2011). PBL in the elementary grades. Buck Institution for Education, Novato, CA. p.5.
- [19] Halvorsen, A. L., 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. East Lansing, MI: Michigan State University, Education Policy Center.
- [20] Harris, C. J., Penuel, W. R., DeBarger, A. H., D'Angelo, C., & Gallagher, L. P. (2014). Curriculum materials make a difference for next generation science learning: Results from Year 1 of a randomized controlled trial. Menlo Park, CA: SRI International.
- [21] Henry, J. (1995). *Teaching Through Projects*. London, UK: Kogan Page and Institute of Educational Technology of Open University.
- [22] Hoyet, R. (2004). Improving Collaborative Skills with Hewlett-Packard's Mission: Project Management. Retrieved January 22, 2015.
- [23] Hussein, B. A. (2015). A Blended Learning Approach to Teaching Project Management: A Model for Active Participation and Involvement: Insights from Norway. *Education Sciences*, 5, 104–125.
- [24] Finn, A., & Bucci, M. (2004). A case study approach to blended learning, retrieved January 15, 2008 from [http://www.centra.com/download/whitepapers/CaseStudy\\_Blend edLearning.pdf](http://www.centra.com/download/whitepapers/CaseStudy_Blend edLearning.pdf).
- [25] Klein, J. I., Taveras, S., King, S. P., Commitante, A., Curtis-Bey L. and Stripling, B. (2009). *Project-Based Learning: Inspiring Middle School Students to Engage in Deep and Active Learning*. New York: NYC Department of Education.
- [26] Kose, U. (2010). A web based system for project-based learning activities in web design and programming course. *Procedia - Social and Behavioral Sciences*, 2(2), 1174-1184.
- [27] Krajcik, J. S., & Shin, N. (2014). Project-based learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (2nd ed.) (pp. 275-297). New York, NY: Cambridge University Press.
- [28] Larmer, J. (2016). It's a project-based world. *Educational Leadership*, 73(6), 66-70.
- [29] Larmer, J., Mergendoller, J. R., Ross, D. (2015). *Setting the Standard for Project Based Learning: A Proven Approach to Rigorous Classroom Instruction*. Alexandria, VA, USA: Association for Supervision and Curriculum Development.
- [30] Lewis, J. P. (1995). *Fundamentals of Project Management*. USA: AMACOM books.
- [31] Marx, R. W., Blumenfeld, P. C., Krajcik, J. S., Blunk, M., Crawford, B., Kelley, B., & Meyer, K. M. (1994). Enacting project-based science: Experiences of four middle grade teachers. *Elementary School Journal*. 94(5): p. 518.
- [32] Moursund, D. G. (1999). *Project-based learning in an information technology environment*. Eugene, OR: ISTE.



- [33] Moylan, W. A. (2008). Learning by Project: Developing Essential 21st Century Skills Using Student Team Projects. *International Journal of Learning* . 2008, Vol. 15 Issue 9, pp:287-292.
- [34] Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: Definitions and directions. *Quarterly Review of Distance Education*, 4, 227-233.
- [35] Parker, W. C., Lo, J., Yeo, A. J., Valencia, S. W., Nguyen, D., Abbott, R. D., Nolen, S. B., Bransford, J. D., & Vye, N. J. (2013). Beyond breadth-speed-test: Toward deeper knowing and engagement in an advanced placement course. *American Educational Research Journal*, 50(6), 1424-1459.
- [36] PMI. (2013). A Guide to the project management body of knowledge. Project Management Institute (5th eds.), Newtown Square, PA.
- [37] PMIEF. (2013). Project management toolkit for youth. Project Management Institute, Newtown Square, PA. PMI. (2019). A Guide to the project management body of knowledge. Project Management Institute (4th eds.), Newtown Square, PA.
- [38] P21: Partnership for 21st Century Learning. (2015). P21 Framework Definitions. Washington, DC: P21.
- [39] P21 and PMIEF. (2014). 21st Century Skills Map – Project Management for Learning. Newtown Square, PA: PMIEF publishing
- [40] Ravitz, J. (2010). Beyond changing culture in small high schools: Reform models and changing instruction with project-based learning. *Peabody Journal of Education*, 85(3), 290-312.
- [41] Stix, A. and Hrbek, F. (2006). Teachers as Classroom Coaches: How to Motivate Students Across the Content Areas. Alexandria, VA, USA: Association for Supervision and Curriculum Development.
- [42] Summers, E. J., & Dickinson, G. (2012). A longitudinal investigation of project-based instruction and student achievement in high school social studies. *Interdisciplinary Journal of Problem-Based Learning*, 6(1), 82-103.
- [43] Thomas, J. (2000). A Review of the Research on Project-Based Learning. San Rafael, CA: The Autodesk Foundation Retrieved Marc 1, 2016 bobpearlman.org/BestPractices/PBL\_Research.pdf
- [44] Tripathi, V. and Goyal, A. K. (2014). Changing Roles and Responsibilities from Traditional project management to Agile project management. *International Journal on Recent and Innovation Trends in Computing and Communication*, Volume: 2 Issue: 5, 1005 – 1009
- [45] Verizon Innovative App Challenge. (2016). 2015 - 2016 Verizon Innovative App Challenge Judging. Retrieved August 24, 2015 from <http://appchallenge.tsaweb.org/rubric>
- [46] Williamson, C. D. (2011). Teaching 21st century skills to high school students utilizing a project management framework (master's thesis). The University of Texas at Austin, United States.
- [47] Wurdinger, S. and Qureshi, M. (2015). Enhancing college students' life skills through project based learning. *Innovative Higher Education*, 40(3), 279-286.
- [48] Zafirov, C. (2013). New challenges for the project based learning in the digital age. *Trakia Journal of Sciences*, 11(3), 298-302.