

**ICT-ASSISTED PROJECT-BASED LEARNING TO PROMOTE L2
ENGLISH LEARNERS' 21st CENTURY SKILLS AND PRODUCTIVE
SKILLS**



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SKILLS**

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ABSTRACT

ICT-ASSISTED PROJECT-BASED LEARNING TO PROMOTE L2 ENGLISH LEARNERS' 21st CENTURY SKILLS AND PRODUCTIVE SKILLS

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This quasi-experimental study aims to reveal the effects of the integration of ICT-Assisted PBL into English Language Teaching Pedagogy to develop students' 21st century skills and L2 productive skills with reference to the United Nations Sustainable Development Goals, to find out EFL students' 21st century skills' levels, and perceived learner autonomy levels, identify students' and lecturer's opinions about such integration. The participants included 120 Turkish B1 level EFL students, enrolled at a state university. While the quantitative data was collected through a number of pre and post scales, students' project products, presentations, and problem-solution essays at the beginning and at the end of the ICT-Assisted PBL implementation process lasted for 14 weeks, the qualitative data was obtained via pre and post semi-structured interviews, written reflections of students, and field notes of the researcher. The study found that there is a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their L2 productive skills, their perceived levels of L2 speaking and writing self-efficacies, their self-perceived autonomy levels in favour of experimental group. In addition, the findings revealed that there is a statistically significant difference in students' level of 4C skills as well as their perceptions of PBL qualifications and 4C skills after being exposed to the ICT-Assisted PBL. The students were found to have overall positive opinions on the ICT-Assisted PBL. ICT-Assisted PBL was indicated to be an effective methodology, which provided gains not only for students but also

the lecturer.

Keywords: ICT-Assisted Project-Based Learning, 21st Century Skills, ELT, Productive Skills, Learner Autonomy



ÖZ

BİLİŞİM VE İLETİŞİM TEKNOLOJİLERİ DESTEKLİ PROJE TABANLI ÖĞRENMENİN ÖĞRENCİLERİN 21. YÜZYIL BECERİLERİ VE ÜRETKEN DİL BECERİLERİNİ GELİŞTİRMEDE KULLANIMI

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Bu yarı deneysel çalışma, Birleşmiş Milletler Sürdürülebilir Kalkınma Hedefleri çerçevesinde öğrencilerin 21. yüzyıl becerilerini ve ikinci dil üretken dil becerilerini geliştirmek için Bilişim ve İletişim Teknolojileri (BİT) Destekli Proje Tabanlı Öğrenmenin (PTÖ) İngiliz Dili Öğretimi Pedagojisine entegrasyonunun etkilerini ve pratik yansımalarını ortaya çıkarmayı; yabancı dil olarak İngilizce öğrenen öğrencilerin 21. yüzyıl becerileri düzeylerini ve algılanan öğrenen özerklik düzeylerini tespit etmeyi, bu tür entegrasyon hakkındaki algılarını belirlemeyi ve bir öğretmenin buna benzer bir uygulama sırasında karşılaşılabileceği olası zorlukları raporlamayı amaçlamaktadır. Katılımcılar, bir devlet üniversitesine kayıtlı B1 düzeyinde yabancı dil olarak İngilizce öğrenen 120 Türk öğrencidir. Nicel veriler 14 hafta süren BİT destekli PTÖ uygulama sürecinin başında ve sonunda bir dizi ön ve son ölçek, öğrenci proje ürünleri, sunumları ve kompozisyonları aracılığıyla toplanırken, nitel veriler ön ve son yarı yapılandırılmış görüşmeler, öğrencilerin yazılı yansımaları ve araştırmacının alan notları ile elde edilmiştir. Araştırmada temel olarak geleneksel öğretim alan öğrenciler ile BİT Destekli PTÖ eğitimi alan öğrenciler arasında ikinci dildeki üretken becerileri, algılanan ikinci dil konuşma ve yazma öz yeterlilik düzeyleri ve algılanan özerklik düzeyleri açısından deney grubu lehine istatistiksel olarak anlamlı bir fark olduğu bulunmuştur. Ayrıca bulgular, BİT Destekli PTÖ'ye maruz kaldıktan sonra öğrencilerin 4C (eleştirel düşünme, işbirliği, yaratıcılık,

iletiřim) d zeyleri ile PT  yeterlilięi ve 4C becerilerine iliřkin algılarında istatistiksel olarak anlamlı bir fark olduęunu ortaya koymuřtur.  ęrencilerin B T Destekli PT  hakkında genel olarak olumlu g r řlere sahip oldukları bulunmuřtur. B T Destekli PT 'n n sadece  ęrencilere deęil  ęretim g revlisine de kazanımlar saęlayan etkili bir y ntem olduęu ortaya  ıkmıřtır.

Anahtar Kelimeler: Biliřim ve İletiřim Teknolojileri Destekli Proje Tabanlı  ęrenme, 21. Y zyıl Becerileri, İngilizce  ęretimi,  retken Dil Becerileri,  ęrenen  zerklięi





To my precious family

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LIST OF ABBREVIATIONS

PD	Professional Development
EAP	English for Academic Purposes
ESP	English for Specific Purposes
MoNE	The Ministry of National Education
MA	Master of Arts
ELT	English Language Teaching
ESL	English as a Second Language
EFL	English as a Foreign Language
SLA	Second Language Acquisition
CLIL	Content Language Integrated Learning
EMI	English as a Medium of Instruction
ICT	Information and Communication Technologies
4Cs	Communication, Collaboration, Critical Thinking, Creativity
AR	Augmented Reality
PBL	Project-Based Learning
ATCS	Assessment and Teaching of Twenty-First Century Skills
OECD	The Organization for Economic Cooperation and Development
PW	Project Work
ZPD	Zone of Proximal Development
STEM	Science, Technology, Engineering and Mathematics
POPBL	Project Oriented Problem Based Learning

Chapter 1

Introduction

1.1 Overview of the Chapter

This introductory chapter provides an outline of the study, which aims at examining the use of ICT-Assisted PBL to promote L2 English learners' 21st century skills and productive skills with reference to UN's SDGs. It also presents the overall purpose, significance of the study and research questions. Finally, definitions of the key terms in the study are given.

1.2 Statement of the Problem

In the twenty-first century, every aspect of life has changed considerably and the world has become completely intertwined due to globalisation and modernization. "To make sense of and function well in this world, individuals need to master changing technologies and to make sense of large amounts of available information" (OECD, 2005, p. 4). These dramatic changes have also shifted how "we learn and teach" (Eaton, 2010, p. 16). In this regard, every society faces countless challenges. Therefore, education is critical in developing skills necessary for students and educators to meet these challenges. Specifically, students must be prepared for future jobs, emerging technologies, and innovations. For this reason, schools need to adapt to new standards, rethink their strategies, and reshape their curricula whilst teachers are required to keep up with the new teaching methods, recent educational trends, and technological tools. It is significant for teachers to deal with these changes and respond to students' 21st century needs in practice. In a similar vein, "a primary challenge is thinking about how we can promote and work with these 21st century skills in our own classrooms" (Halverson, 2018, p.1) alongside existing ones. As a result, education is undergoing significant changes to keep up with today's globalized world, where knowledge transmission leaves its place to knowledge transformation fostering active learning methods and inquiry based pedagogies. The current technology-driven rapidly changing world requires learners to gain 21st century skills including 4Cs, authentic problem solving and ICT for knowledge construction and

co-construction (Dede, 2009; Voogt & Roblin, 2012; Chai et al. 2015; Chai & Kong, 2017).

As a consequence of globalization and constantly developing technologies, quality education systems which integrate life skills, social adaptation, and 21st century skills have become essential. In that sense, language classes need to become places that support 21st century skills and technologies, which facilitate our students' success. As educators, it is one of our prior responsibilities to prepare our students for the unique demands of a 21st century world via transforming our classes that enable our students to acquire the learning and innovation skills, which they need to be successful in work and life. In order to respond to the needs of the globalized world, it is inevitable for them to keep up with the recent technologies and improve their lifelong skills. As Prensky (2012) suggested, it is impossible "win the future with the education of the past" (p.2). Therefore, educators seek for functional and transformational methods to prepare students' to this constantly changing and developing era. PBL, as one of the innovative approaches to learning, has been used by teachers to meet the demands of the 21st century (Harun, 2006). In this regard, this study incorporates ICT-Assisted PBL while preparing our students for this global society. Grounded on this, implementing PBL leveraged with emerging technological tools and collaborative tasks are aimed to develop not only L2 productive skills but also 21st century skills of the students. By means of participating in real-world projects with reference to SDGs, the students are expected to find solutions to real life problems, engage in ICT tools while creating websites, AR integrated brochures, and mobile applications and accomplish L2 writing tasks which they find one of the most difficult language skills to master.

A review of the literature has shown that the related studies on 21st century skills are about conceptualizing and defining it. In the same vein, the descriptive studies are related with the students', teachers', and administrators' perceptions of 21st century skills. Although some studies indicated the importance of integrating the 21st century skills into teaching programs and curriculum; there are only a few studies that presented the implementation of 21st century skills. Specifically, for ELT, to my best knowledge, there is no study conducted with L2 English learners at tertiary level,

which presents an implementation to develop both L2 productive skills and 21st century skills by means of ICT-Assisted PBL with reference to the UN's SDGs. As a response to this gap, this study focuses on designing and implementing ICT-Assisted PBL with the inclusion of emerging ICT tools and collaborative tasks to foster not only L2 productive skills but also 21st century skills and to explore the effects of such a program in EFL context.

1.3 Purpose of the Study

The aim of this study is to explore (a) the effects of the integration of ICT-Assisted PBL into English language instruction to develop students' 21st century skills and L2 productive skills; (b) learners' perceptions of 21st century skills, L2 productive skills, and autonomy levels after ICT-Assisted PBL; (c) students' opinions about such integration; and (d) teacher' opinions on the implementation of ICT-Assisted PBL.

1.4 Research Questions

1. Is there a statistically significant difference in students' level of 4C skills (critical thinking, collaboration, creativity, communication) after being exposed to the ICT-Assisted PBL?
2. Is there a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their productive skills in L2?
3. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their perceived levels of L2 speaking and writing self-efficacies?
4. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their self-perceived autonomy levels?
5. Is there a statistically significant difference in the perceptions of students regarding
 - a. PBL qualifications
 - b. 4C skillsafter being exposed to the ICT-Assisted PBL?

6. What are the students' opinions about the ICT-Assisted PB instruction?
7. What are the opinions of the lecturer about the implementation of the ICT-Assisted PBL?

1.5 Significance of the Study

In today's world, due to huge technological and global changes happening at a rapidly accelerating rate, acquiring 21st century skills in an education program is a must for students to become successful in school and be active citizens throughout their lives beyond school, to get prepared for the demands of new global economy and their future careers. Therefore, as teachers, it is our responsibility to be aware of the fact that our in-class implementations are highly important for improving the quality of education. In this regard, unleashing the power of our 21st century students will be accomplished by means of improving the world they live in, and helping each individual improve in that process (Prensky, 2016). Through relevant and authentic learning experiences empowered with real-world problems, the students themselves could recognize their own local and global world and this provides meaningful learning opportunities to them as they have a chance to come up with, and implement, solutions to these problems. For these reasons, this study offers ICT-Assisted PBL as an innovative multidisciplinary pedagogical approach to learning including a multitude of strategies critical for success in the twenty-first century, specifically for 4Cs and L2 productive skills, which are often found out to be one of the most challenging productive skills for them. As suggested by Bell (2010, p.1) "students drive their own learning through inquiry, as well as work collaboratively to research and create projects that reflect their knowledge. From gleaming new, viable technology skills, to becoming proficient communicators and advanced problem solvers". As stated by Maley (2017, p.8), "language teachers are more than just teachers of language". Thus, it is feasible to educate students who are not just technically adept but also internationally aware and cautious, and who act as actors in solving real-world problems. Grounded on this, instead of turning a blind eye to these global challenges in our classrooms, we, as twenty-first-century teachers, have the capacity and technology to confront them critically and creatively.

In the reviewed literature, there has been a number of descriptive studies

investigating the pre-service teachers' perceptions and levels of 21st century skills, teachers' views on 21st century learning and teaching, students' perceptions on 21st century skills. On the other hand, there have been a limited number studies that investigate the implementation and assessment of 21st century skills in EFL classroom. In this regard, this study aims to find out effective ways to improve students' 21st century skills in EFL classroom with the integration of ICT tools within PBL and aims to fill in the gap in the literature via suggesting an in-class implementation to develop students' 21st century skills, specifically the 4Cs and L2 productive skills in an integrated way. Regarding the content of the projects, to my best knowledge, there has been only one study integrating SDGs into English teacher education pedagogy (Akyüz, 2019) and no study integrating SDGs into ELT pedagogy. In the same vein, studies on PBL mainly concentrated on either language skills of students or 21st century skills only. However, this empirical study will act as a pioneer in terms of integrating the 21st century skills development with language development of Turkish EFL learners by means of using ICT-Assisted PBL with reference to SDGs. Grounded on this, the objective of this study is twofold. While the students' 21st century skills are aimed to be developed, their L2 productive skills are targeted to be improved at the same time. The study is significant as the results are expected to give in-depth insights on the implementation, assessment, and learning environment of ICT-Assisted PBL to foster students' 21st century skills and L2 productive skills. The findings will be considered to be valuable to policy makers, teachers, stakeholders, curriculum developers, material designers and course book writers.

1.6 Definitions

1.6.1 English as a foreign language (EFL). Teaching EFL is teaching, “English is a foreign language for learners in whose community English is not the language of communication” (Thornbury, 2006, p. 74).

1.6.2 Project based learning. It is defined as “a series of individual or group activities that involve language/content learning through planning, researching (empirical and/or document), analyzing and synthesizing data, and reflecting on the process and product orally and/or in writing by comparing, contrasting, and justifying alternatives” (Beckett, 1999, p. 4).

1.6.3 Learner autonomy. It is “the ability to take charge of one’s own learning... (and)... to have, and to hold the responsibility for all the decisions concerning all aspects of this learning like; determining the objectives, defining the contents and progressions, selecting methods and techniques to be used, monitoring the procedure of acquisition properly speaking (rhythm, time, place...) and evaluating what has been acquired” (Holec, 1981, p. 3).

1.6.4 21st century skills. They are “Learning and renewal knowledge, media and technology life and career skills that individuals need to adapt to the ever-more globalizing world with scientific and technological developments and to achieve success in the competitive labor market” (P21, 2009, p.1).

1.6.5 Critical thinking. It is “an active, persistent, and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends” (Dewey, 1909, p. 9).

1.6.6 Communication. “An act or instance of transmitting” (Merriem Webster Online Dictionary)

1.6.7 Collaboration. “To work jointly with others or together especially in an intellectual endeavor” (Merriem Webster Online Dictionary)

1.6.8 Creativity. “The ability to create” (Merriem Webster Online Dictionary)

1.6.9 Speaking. It is “a productive skill that involves many components, such as grammar, strategy, sociolinguistics and discourse; for him speaking is more than simply making the right sounds, choosing the right words or getting the constructions correct” (Chastain, 1998, pp. 330-358).

1.6.10 Writing. It is “a set of visible or tactile signs used to represent units of language in a systematic way, with the purpose of recording messages which can be retrieved by everyone who knows the language in question and the rules by virtue of which its units are encoded in the writing system” (The Blackwell Encyclopaedia of

Writings Systems, Florian Coulmas).

1.6.11 Augmented reality. It “is a new-generation technology that allows users to experience assigned video, picture, audio, or 3D objects upon scanning a picture on mobile devices” (Ro, Brem & Rauschnabel, 2018).

1.6.12 Sustainable development goals. They are “the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice” (UN, 2015, p. 3).



Chapter 2

Literature Review

2.1 Introduction

This chapter focuses on the literature on key concepts, theorizing and research findings central to the study. First of all, the theoretical framework of PBL, its link to theories of learning, its distinguishing features, major elements, its advantages and disadvantages in ELT are presented in detail. Then, studies conducted on PBL in EFL context and L2 productive skills are given. Second, learner autonomy is detailed referring to the previous studies conducted through implementing PBL. Subsequently, definitions of 21st century skills and key frameworks for 21st century skills are introduced with in-depth insights. Thirdly, integrating 21st century skills into language education and research on PBL and 21st century skills and the Integration of 4Cs are presented in detail. Additionally, the importance of ICT integration and SDGs is outlined with reference to the previous studies in the literature.

2.2 Project-Based Learning (PBL)

Project-Based Learning (PBL) tracing back to 20th century and Dewey's Practical Method (1915) is referred to as Project Method (Kilpatrick, 1918), Project Work (Beckett, 1999; Fried-Booth, 2002), Project Approach (Levis & Levis, 2003), and Project-Printed Approach (Carter & Thomas, 1986). It was first introduced by Snedden in order to teach science in American vocational agriculture classes (Beckett & Slatter, 2018) and then developed by Kilpatrick for teachers through the Project Method as "a hearty, purposeful act" (Kilpatrick, 1918). As a reaction to emerging pedagogical theories of learning, Project-based language learning emerged in the mid-1970s with the use of project work in other educational fields as a reaction to emerging pedagogical theories of learning such as "learner-centred teaching, learner autonomy, the negotiated syllabus, collaborative learning, and learning through tasks" (Hedge, 1993, p. 276). In terms of second language education, PBL was initially conceived of due to perceived inadequacies of Krashen's Input Hypothesis (Beckett, 1999) and a shift from traditional teacher-centered pedagogical approaches to student-centered ones (Hedge, 1993). With the remarkable developments in technology, the demands of language education require a very different set of skills and competencies from

students to function effectively in today's globalized world (Dede, 2007; Kalantzis & Cope, 2008; Wrahatnolo & Munoto, 2018). By means of these paradigm shifts in education from traditional transmissive models of learning and teaching to transformational models requiring active learning experiences and involvement of learners, innovative learning methodologies become necessary for improving students' second language and 21st century skills in language classrooms. PBL, as one of these innovative approaches to learning, integrates a variety of methods that are crucial for success in the 21st century (Harun, 2006). According to Bell (2010), "from gaining new, viable technology skills, to becoming proficient communicators and advanced problem solvers, students benefit from this approach to instruction" (p.1). In that sense, for more than three decades, PBL has been promoted as an effective method for encouraging intentional language acquisition (Beckett, 2005; Fried-Booth, 1986; Legutke & Thomas, 1991; McPherron & Randolph, 2013; Poonpon, 2018; Stoller, 2006; Stoller & Myers, 2020). PBL promotes "simultaneous acquisition of language, content, and skills" (Beckett & Slater, 2005, p. 108). In addition, PBL allows students to engage in learning by utilizing language as a resource or tool to acquire more language, subject, and skills at the same time (Beckett, 1999). When technology is employed as a tool and content in projects, students can obtain a deeper grasp of subject matter and comprehend the links between theory and practice (Krajcik, Blumenfeld, Marx, & Soloway, 1994).

2.2.1 Theoretical framework. PBL has a long history (Grant, 2002). The main theories that reside at the PBL are Piaget's theory of Constructivism, Vygotsky's theory of Social Constructivism, and Experiential Learning Philosophy, which emphasized the cultivation of problem solving, critical-thinking ability, and other learning skills to prepare students for a changing world (Beckett, 1999). While learning through PBL, L2 learners use language as a medium to learn language, content, and sociocultural knowledge in an integrated way. In that sense, multiple frameworks have been formed to inspect PBL, specifically within the inclusion of technology in the projects (Beckett & Slater, 2018).

2.2.1.1 Piaget's theory of constructivism. John Dewey advocated for "learning by doing" as early as the 1900s. Constructivism and constructionism both represent

this notion. Individuals develop knowledge through interactions with their environment, according to constructivism (Perkins, 1991; Piaget, 1969; Vygotsky, 1978), and each individual's knowledge construction is unique. Therefore, by means of making investigations, involving in different conversations or activities, an individual learns via constructing new knowledge by building on their current knowledge. In that sense, students construct their knowledge by building up existing knowledge and through experiences. Discovery learning is one way of constructivism through which can be applied to education as it is based on the idea that "children learn best by actively exploring and physically doing" (McLeod, 2015, p. 35). The implementation of constructivist theories creates an appropriate and meaningful environment that is conducive for PBL. In line with this, constructionism (Harel & Papert, 1991; Kafai & Resnick, 1996) posits that individuals learn better when they are constructing an artifact that can be shared with others and reflected upon. Another important feature of constructionism is that the artifacts must be personally relevant in order for people to become interested in learning. In this regard, with a specific emphasis on the individual learner, PBL also strives for "considerable individualization of curriculum, instruction and assessment" (Moursund, 1998, p.4).

2.2.1.2 Vygotsky's Socio-Cultural Theory. The Russian Psychologist Vygotsky (1978) proposed The Sociocultural Theory to emphasize the social aspect of the learning environment and focused on "learning by experience and through social and interpersonal interaction" (Scholnick, Kol & Abernethy, 2006, p.13) via two key concepts: zone of proximal development and scaffolding. According to Vygotsky (1978), the ZPD is the region where the most delicate teaching or direction should be given, allowing the children to build abilities that they will later employ on their own through the development of higher mental processes. ZPD refers to a set of tasks that a kid can complete with the assistance or instruction of others but cannot complete on their own. There are two tiers within the ZPD in this context. The first is the actual development level, which is determined by the maximum number of tasks that can be completed autonomously. The second level is potential development, which is the upper limit, accomplished with the help of a more competent person. In line with this, scaffolding is a teaching strategy, which provides individualized support for a learner in which an instructor or more experienced peer assists in structuring or organizing a

job so that they can do it effectively. In a classroom context, for example, the teacher first offers hints on how to approach the problem or topics, and then progressively removes these indications as the youngster learns the capacity to solve the task without assistance or guidance. Then, the student has a chance to become aware of his/her potential in effective learning process.

PBL provides students tasks in which they can facilitate mutual help by working collaboratively. By means of pair and group work activities, students contribute each other's language development. In addition, the reflection component is supported in all areas of constructivist theories. Students are expected to apply newly acquired knowledge into their existing knowledge via reflecting on the new information and this synthesis fosters the new knowledge (Schcolnick, Kol & Aberbanel, 2006, p. 14).

2.2.2 Definitions and distinguishing features of PBL. PBL is a paradigm that includes learning via projects that involve students in design, problem-solving, decision-making, or investigative activities; allow them to work independently for lengthy periods; and produce actual products or presentations (Jones, Rasmussen, & Moffitt, 1997; Thomas, 2000). In that sense, some of the definitions of PBL are given below:

PBL is

“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” (Buck Institute for Education, n.d.).

“an activity in which students develop an understanding of a topic or issue through some kind of involvement in an actual real-life problem or issue and in which they have some degree of responsibility in designing their learning activities” (Morgan, 1983, p.1).

“a series of individual or group activities that involve language/content learning through planning, researching (empirical and/or document), analyzing and synthesizing data, and reflecting on the process and product orally and/or in writing by comparing, contrasting, and justifying alternatives” (Beckett, 1999, p. 4)

“a long-term activity that involves a variety of individual and cooperative tasks such as developing a research plan and questions, and implementing the plan through empirical or document research that includes collecting, and reporting data orally and/or in writing” (Beckett, 2002, p.54).

“a student-centered and driven by the need to create an end-product. However, it is the route to achieving this end-product that brings opportunities for students to develop their confidence and independence and to work together in a real-world environment” (Fried-Booth, 2002, p.6).

“a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured among complex, authentic questions and carefully designed projects and task” (Markham et al., 2003, p. 4).

“student-driven and teacher-facilitated approach to learning” (Bell, 2010, p.39).

Based on literature review, some of the distinguishing features of PBL projects are as follows:

- a. An authentic driving question or problem, a community of inquiry, and the use of cognitive technology-based methods to produce a product (Krajcik, Blumenfeld, Marx & Soloway, 1994; Curtis, 2002);
- b. A product or presentation which can be used for practical purposes (Sumarni, 2013);
- c. Real life problems (Thomas, 2000; Gültekin, 2005; Prensky, 2018);
- d. Students can create products to solve problems while learning (Köse, 2010);
- e. Students collaborate within a limited time to accomplish specific goals (Gültekin, 2005; Simkins, 1999; Vasiliene-Vasiliauskiene et al., 2020);
- f. Various disciplines are integrated within a multidisciplinary principle for dealing with these interdisciplinary problems (Butvilas et al., 2016; Expeditionary Learning Outward Bound, 1999; Sumarni, 2013);
- g. Students identify the concerns, discuss different perspectives, collect information, evaluate information, draw specific conclusions, create a product (Blumenfeld et al., 1991), and build knowledge (Köse, 2010);
- h. Authentic content and assessment, teacher facilitated learning instead of teacher-driven pedagogy (Moursund, 1999);
- i. Cooperative learning, reflection, and incorporation of integrated skills

(Diehl, Grobe, Lopez & Cabral, 1999).

As Thomas (2000) indicated there have been five basic criteria which a project must possess so as to be considered an instance of PBL. These included “centrality, driving question, constructive investigations, autonomy, and realism” as explained in detail above.

1. Centrality: PBL projects are central, not peripheral to the curriculum. According to Thomas (2000), this criterion has two justifications. Initially, projects are accepted as the curriculum because the project is the central teaching strategy which students learn the major concepts of the discipline within PBL process. Exceptionally, in some cases, project work integrates with traditional instruction for providing illustrations, examples, additional practice, or practical applications. On the other hand, concerning this criterion, these "application" projects are not taken into account as PBL instances. In addition, the centrality criterion suggests that projects that students learn things outside the curriculum, namely "enrichment" projects are also not considered as examples of PBL despite their appealing and engaging features. This means that the PBL projects are considered as the primary tool for content learning, and assessment at the same time.

2. Driving question: Projects focused on questions or problems that drive students to encounter principles of a discipline. The project definition must “be crafted in order to make a connection between activities and the underlying conceptual knowledge that one might hope to foster” (Barron et al., 1998, p. 274). As Thomas (2000) suggested, this is generally achieved with a “driving question” (Blumenfeld et al., 1991) or an “ill-defined problem” (Stepien & Gallagher, 1993). Even though PBL projects may comprise of various themes or interdisciplinary topics, the activities, products, and performances that students spend their time must be “orchestrated in the service of an important intellectual purpose” (Blumenfeld et al., 1991). In that sense, driving questions must be formed in relation to the content, enhance student engagement, and foster active intellectual solutions.

3. Constructive investigations: Projects involve students in a constructive

investigation. As Thomas (2000, p.3) claimed, “an investigation is a goal-directed process that involves inquiry, knowledge building, and resolution”. In that sense, these investigations included design, decision-making, problem-finding, problem-solving, discovery, or model-building processes. However, the central activities of the project must involve the transformation and construction of knowledge by the students so as to be taken into account as a PBL project, (Bereiter & Scardamalia, 1999). On the other hand, when the students have no difficulty in involving in the central activities of the project or deal with it by means of the already-learned or gained information or skills, the project is still accepted as an exercise, rather than a PBL project. In this regard, projects are sources for students to identify problems, develop and design solutions, and create an end product such as a presentation, report, invention, or model.

4. *Autonomy: Projects are student-driven*. As PBL projects are not teacher-driven, laboratory exercises and instructional booklets are not considered as examples of PBL despite their problem-focused and curriculum centered features. Moreover, PBL projects never possess predetermined outcomes and follow predetermined paths. On contrary, PBL projects foster student autonomy, student choice and voice with, time-management, and self-responsibility rather than conventional instruction and traditional projects. As PBL projects are student-centered, teachers play role as resources, facilitators and guides, but it is the students who define, choose and conduct their projects.

5. *Realism: Projects are realistic or authentic, not school-like*. According to Thomas (2000), projects should possess authentic, real-life features that represent authentic efforts in solving or investigating real-world dilemmas rather than academic pursuits. These features include the topic, the tasks, student roles, the context the project is conducted, the collaborators working with students on the project, the products, the audience, or the criteria by which the products or performances are evaluated. In this regard, PBL interconnects real-life challenges where the focus is on authentic real life problems or questions and where solutions have the potential to be implemented rather than simulated ones. According to Prensky (2018, p.2), “real-world projects replace THE MESS (i.e. linear classes in math, English—or another language—science and social studies)” as they indicate the real road to a true

education. Significantly, real-world projects within PBL gives students chance to solve real, world improving problems rather than fake projects used merely within academic education, where the metric is meeting standards. On the other hand, all real-world projects are judged on their quantifiable beneficial influence on the world. These are the projects where students can point to anything in their environment that they previously thought was a problem, but which they and their team have improved (Prensky, 2018, p.10). In this regard, as Prensky (2018) suggested the students within small teams attack real problems anywhere at any age on the community, culture, national, and world scales.

2.2.3 Elements of PBL. Regarding the instructional components incorporated into PBL process, the scheme (Figure 1) created by Lorin (2013) indicating the analysis of the essential elements of PBL and essential project design elements (Figure 3) proposed by Larmer, Mergendoller and Boss (2010) are in accordance with each other. However, the first element “need to know” stands for significant content in Lorin’s scheme. To begin with, the significant content is a core of a PBL comprising of certain knowledge and skills to gain. The project generally starts with an entry event that initiates the curiosity of students. Content is enriched via a driving question, guiding students to investigation, giving them a sense of purpose and challenge (Larmer, Mergendoller & Boss, 2010) yet still, leaving a space for their creativity demonstration through the element of students’ voice and choice (Vasiliene-Vasiliauskiene et al., 2020).

PBL enables students to propose their own ideas and choices on planning the process and solutions, have a chance to establish their own creations and products, and the topic of their project. As aforementioned, PBL enriches development of 21st Century skills including 4Cs and technology integration skills. In terms of inquiry and innovation, PBL facilitates meaningful learning of students while forming their own questions and drawing their own conclusions with an introduction of a new answer to a driving problem, a new product, or an individual solution at the end of the project. Lastly, feedback and revision, together with publicity presented product are reflections of real-world competence and demonstration of the outcomes of the students to real audiences.

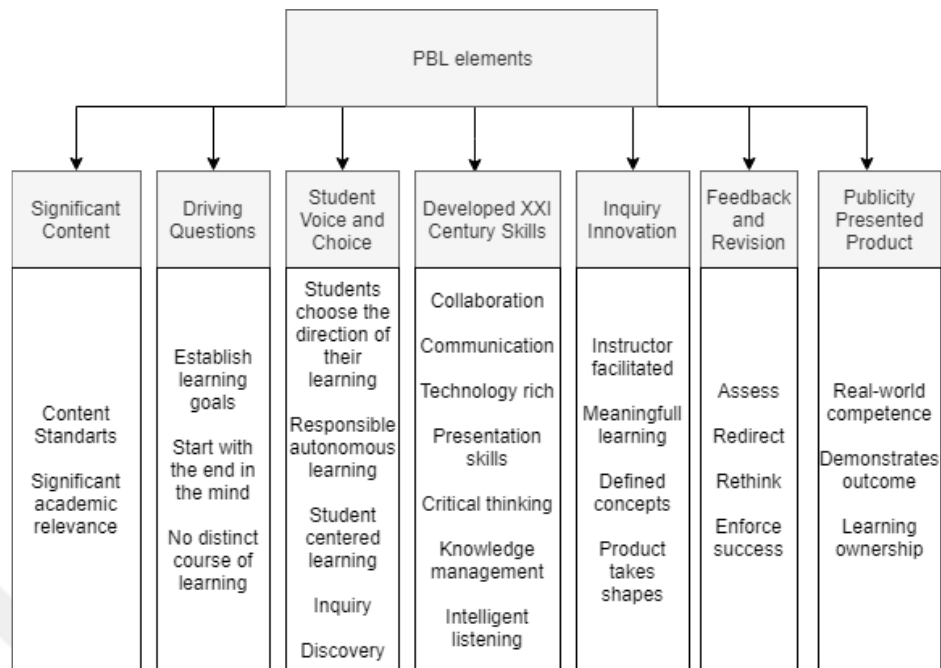


Figure 1. The elements of PBL (Lorin, 2013)

In addition, Larmer, Mergengoller, and Boss (2015) described eight essential elements of project design including “challenging problem, sustained inquiry, authenticity, student voice and choice, reflection, critique and revision, public product” as indicated in Figure 2. In this regard, each project begins with a challenging real life problem. Then, students try to find out original and authentic solutions to this problem with an in-depth investigation. Via engaging in the problem they choose and creating their own project products to meet the real-world needs, they have a say in each project development step. During the design and implementation process, students reflect on what, how, and why they are learning. Through peer feedback, rubrics, and formative evaluation, students improve their projects. The last element, which is a presentation of problem solution or a project product, makes what students learn tangible and makes student work public via creating a “learning community”.



Figure 2. Essential project design elements (Larmer, Mergengoller & Boss, 2015)

In this regard, students participate in active learning and employ higher level thinking abilities as they advance through the PBL process. “PBL engages them with learning in all six levels of Blooms Taxonomy (1956), which are (a) knowledge, (b) comprehension, (c) application, (d) analysis, (e) synthesis, and (f) evaluation” (Moylan, 2008, p. 288). PBL approach transforms the students’ role as active agents and the teacher’s role as facilitators, coping with the boundaries of traditional classes and empowering teachers to apply different pedagogical tools according to students’ interests and needs. In PBL, teachers are resource providers of input, acting as facilitators and the co-learners (Vasiliene-Vasiliauskiene et al., 2020). As Boss and Krauss (2007) suggested, the application of PBL encourages teachers for carrying out more research and/or searching for better classroom practice advice. Moreover, PBL necessitates teachers to rethink and redesign assessment methods to better evaluate multiple achievements (Bell, 2010; Butvilas et al., 2016; Hutchison, 2016).

To this end, The Buck Institute of Education (2015) also developed a model for excellent Project Based teaching practices to assist instructors in making the transition from a standard teaching style to a Project Based style, which includes seven characteristics including “designing, aligning to standards, building the culture, managing activities, scaffolding student learning, assessing student learning, and coaching”. Initially, teacher designs a project in accordance with the content of the

lesson and according to students' needs and interests. When creating a project, content standards are used to guarantee that critical components of the content area are covered and handled. Teacher encourages student inquiry via collaborative practices. Teacher sets the tasks, timetables, checkpoints, and deadlines via collaborating with the students to utilize materials, as well as to create the final product. Teacher provides tools, sources, and ongoing support to students to accomplish their project goals. Lastly benefiting from formative and summative assessments, teacher evaluates the students as well as their peers. For addressing students' needs and teachers encourages students in each phase.

2.2.4 Steps in projects. According to Chandrasekaran et al. (2012), PBL process includes the following steps which “students are encouraged to collaborate and communicate effectively, improve individual learning capability, and acquire self-management skills” (p.2).

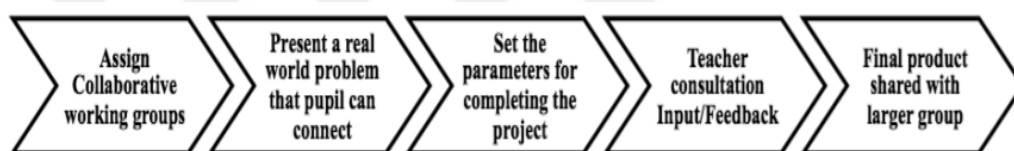


Figure 3. Steps of PBL (Chandrasekaran et al., 2012)

Vasiliene-Vasiliauskiene et al. (2020) pointed out the importance of analyzing PBL process in three stages to figure out the interaction between the PBL and teachers role:

- *Pre-project stage.* In this initial stage, teacher provides students input for assisting them choosing a topic, generating ideas via brainstorming, leading them to create their project goals;
- *During-project stage.* During this phase, teacher as a facilitator, guide students gather ideas, define objectives, create a timeline and provide essential input for language skills. Teacher supports students' progress via giving suggestions to solve problems and assist them when they need.
- *Post-Project Stage.* In this last stage, teacher within a role of a commentator,

focuses on student outcomes and learning, shares the reflection, figures out strengths and weaknesses, and offers suggestions for development. It is during this final stage that teacher makes an overall evaluation with reference to student feedbacks and helps revision and improvement of the project.

2.2.5 Advantages of PBL. Dewey (1938) emphasizes, “learning by doing has great benefit in shaping students’ learning. High-quality experiences, as well as continuity of experiences, are paramount”. For a long time, PBL was applied in various areas such as technical, engineering, and foreign language education. It is now one of the most dominant methodologies in a wide range of courses and programs all around the world (Hutchison, 2016).

2.2.5.1 PBL increases students’ learning motivation and self-esteem. When implemented successfully, PBL becomes a highly motivating method for students as they actively involved in their own learning and create not only complex but also high-quality work (Blumenfeld et al., 1991; Wrigley, 1998; Raghavan et al., 2001; Doppelt, 2003; Elam & Nesbit, 2012). In this regard, students trained with PBL are found out to be more successful and have a higher motivation level compared to the ones treated by the conventional instructional methods (Sumarni, 2013). In parallel with this, Shin (2018) examined the effects of PBL on students’ motivation and self-efficacy in tertiary level. The students were expected to work collaboratively on video creation projects with the topic of “resume and cover letter video” and prepare their future job interviews. After working for 2-3 weeks, the projects were uploaded to their websites or on YouTube for presentation. The results indicated that video creation projects had positive impacts on students’ motivation, cooperation skills, and self-efficacy. In addition, PBL is an effective approach to develop self-esteem of students (Railsback, 2002).

2.2.5.2 PBL increases students’ academic achievement. PBL provides opportunities for meta-cognition (Downing et al., 2009) and found out to be an effective method for boosting academic achievement and performance (Baş & Beyhan, 2010; ChanLin, 2008; George Lucas Educational Foundation, 2001; Erdem, 2012;

Ergül & Kargin, 2014; Gültekin, 2005; Yalçın et al., 2009). For instance, Pichailuck and Luksaneeyanawin (2017) conducted an action research and investigated the impacts of PBL on Thai EFL learners' academic achievement. The participants were expected to work on three projects including "Aesop's Fables Role Play, The Survey Project, and The Cooking Project". The results indicated that PBL increased academic achievement and learner autonomy levels of the students at the same time.

2.2.5.3 PBL increases cooperation/collaboration/team work ability. According to Galvan and Coronado (2014), PBL is "an instructional strategy in which students work cooperatively over time to create a concrete, substantial product" (p.40). As suggested by Bell (2010), PBL facilitates "active listening skills.... creativity... productive communication, respect for others, and teamwork" (p.41). Within PBL, students learn to collaborate via working in teams (Barrs, 2012; Elam & Nesbit, 2012; Wrigley, 1998) and have a chance to enhance cooperative or collaborative learning skills (George Lucas Educational Foundation, 2001; Özel, 2013; Scott, 1994; Thomas, 2000; Wrigley, 1998). In this regard, in Nepalese EFL context Giri (2016) found out that PBL fostered co-operation and collaboration skills of the students while trying to find out solutions to local problems in their area. In a parallel study, in Thai EFL context, Wongdaeng and Hajihama (2018) suggested PBL as an effective method promoting collaboration, communication and learning motivation to learn English. In a more recent research conducted in United Arab Emirates, Bani-Hamad and Abdullah (2019) emphasized the positive outcomes of PBL on improving EFL students' communication and collaboration skills upon creating four real-life projects "beehive gear, emergency car water tank, electricity from plants, and spilled petroleum sensor", which they choose from desert life challenges.

2.2.5.4 PBL enhances higher order thinking and problem solving skills. According to Ball (2016, p.1), "PBL situates student voice and capacity at the center of culturally-responsive curriculum has the potential to spark student passion for problem-solving real world issues that directly affect them, their family, and/or their community". PBL offers the ability to improve students' 21st century abilities via involving them in these real-world activities (Bell, 2010; Han et al. 2015; Hutchison,

2016). PBL encourages them to develop and practice these problem-solving abilities. As a result, it gives a chance for multidisciplinary research to complete the project's many stages. The PBL helps students acquire real-world skills such as the ability to work well with others, make decisions, and take initiative, as well as the capacity to solve complicated problems, communicate well, and manage their time (SRI, 2000; Sumarni, 2013; Wrigley, 1998; Yalçin et al., 2009). The path to the final result provides opportunity for students to gain confidence and independence, as well as to collaborate in a real-world setting, by cooperating on a goal that they have defined for themselves rather than one that has been pushed on them (Blumenfeld et al., 1991). Different studies have also reported that it offers development of complex skills, such as higher-order thinking and problem-solving skills (Ivanitskaya et al., 2002; Scott, 1994; SRI, 2000; Thomas 2000; Tretten & Zachariou, 1995). For instance, Bradley-Levine and Mosier (2014) figured out that in PBL lessons, students with limited verbal skills and background knowledge learn more. PBL helps students to gain “new patterns of thinking, [...] they learn how to capitalize on the wisdom of the group, and, most importantly, they continually learn how to learn together” (Boss & Krauss, 2007).

2.2.5.5 PBL increases the ability to communicate. Students gain research, team organizing, and communication skills within PBL process (Yalçin et al., 2009). As students learn to reflect their thoughts, explain their ideas, and convince each other within PBL process, they have an opportunity to improve positive communication skills as well (Sumarni, 2013). Students not only defend their ideas but also learn to listen to their opponents and open to the opinions of others within group discussions. In this regard, PBL encourages social learning by allowing students to practice and master 21st century skills like communication, negotiation, and teamwork (Eggen & Kauchak, 2007). They generate ideas and listen attentively to their group members as they work on these tasks. Active listening skills are taught to them, which improves collaboration and creativity (Zhou, 2012). While generating ideas together, students acquire the core skills of effective communication and respect for others.

2.2.5.6 PBL increases students' skill in managing learning resource and improve research skills. During the PBL process, specifically while trying to find solutions for projects, students search from a variety of sources and learn how to use the knowledge in the solution process. Therefore, the PBL develops students' information seeking, gathering, and presenting skills. Students become better researchers, problem solvers, and higher-order thinkers as a result of PBL (Gultekin, 2005). While learning by doing, they obtain more knowledge. In a similar vein, Chu, Chow, Tse, and Kuhlthau (2008) aimed to explore how research skills of learners improved through PBL. For this reason, students wrote a report and gave a presentation at the end of two group projects. The results revealed that PBL developed students' collaborative research skills significantly in Chinese context.

2.2.5.7 PBL creates fun learning. PBL creates an enjoyable, interesting and authentic learning environment for students via blocking the boring routine of the traditional classroom (Jumaat & Tasir, 2013; Yalçin et al., 2009) and providing them with rich learning experiences in their learning process (Eskrootchi & Oskrochi, 2010; Gültekin, 2005; Papanikolaou & Boubouka, 2010). In a recent study conducted by Sirisrimangkorn (2018), the use of PBL was found to be encouraging for promoting learners' language learning and an enjoyable way of improving speaking skills in a communicative context.

2.2.5.8 PBL increases students' attitudes toward learning. PBL is found out to be an effective method for building positive attitudes on learning (Baş & Beyhan, 2010; Chang et al., 2011; Gültekin, 2005; Erdem, 2012; Morgil et al., 2008; Yalçin et al., 2009). Also, Thomas (2000) suggested that PBL increases attendance and improves positive attitudes toward learning. Moreover, the students who are educated by PBL was found out to be more successful and have higher attitude levels towards the lesson compared to the ones trained with conventional instructions based on student textbooks (Baş, 2011).

2.2.5.9 PBL increases students' creativity. PBL is an example of a curriculum that prepares students by assisting them in acquiring the skills needed to improve their creativity. Stimulation with project work will encourage the emergence of individual and group creativity (Zhou, 2012). In that sense, Tamim and Grant (2013) asserted that

teachers found PBL as an effective method improving creativity and collaboration of the students. In addition, Astawa, Artini and Nitiasih (2017) conducted a mixed-method study on the effect of PBL on students' English Productive Skills in Bali-Indonesia and revealed that the students found PBL as an effective approach to improve enthusiasm, confidence, creativity, and collaborative learning skills. In another study, Astawa (2018) examined the impacts of PBL in Indonesian context and concluded that 10-week activities enhanced students' critical thinking skill, creativity, communicative, and collaborative learning ability.

2.2.5.10 PBL lowers students' anxiety level in the learning process. PBL was found to decrease the anxiety level of the students (Erdem, 2012). As PBL boosts desire to study, the students get more involved in the subject, and this directly reduces the level of anxiety. When students are passionate about what they are studying, they become more engaged in the topic, their anxiety levels decrease, and their interest in subject matter grows. Students who are enthusiastic about learning tend to remember what they have learned rather than forgetting it as soon as the test or the exam is completed (Sumarni, 2013).

2.2.5.11 PBL increases learner autonomy. As suggested by Kokotsaki et al. (2016), students' autonomy, teamwork, and reflection via real-world activities are all hallmarks of PBL. Students who participate in projects are more responsible for their own learning compared to the ones participating in conventional classroom activities (Boaler, 1997; SRI, 2000). In this regard, there have been a number of studies sought for the role of PBL on learner autonomy in tertiary education and yielded positive results (Akhand, 2015; Diaz Ramirez, 2014; Güven, 2014; Hafner & Miller, 2011; Loi, 2017; McCarthy, 2010; Mesa Villa & Armstrong, 2004; Rostom, 2019; Sarwar, 2010; Smith, 2005; Stefanou, Stolk, Prince, Chen & Lord, 2013; Sukerti & Yuliantini, 2018) in EFL context.

2.2.5.12 PBL increases interdisciplinary knowledge. In comparison to the typical "stand and deliver" classroom atmosphere, a PBL environment can give an actual, contextual learning, constructivist, multidisciplinary, cooperative learning context with numerous benefits (Halvorsen, 2018). In this regard, PBL enables deeper

and integrated understanding (Bell, 2010), builds conceptual understanding (Capraro & Jones, 2013), combines the use of interdisciplinary knowledge in different forms (Helle, Tynjala & Olkinuora, 2006), and eliminates fragmented learning and makes connections between subject areas (Hall, 1995; Ivanitskaya et al., 2002).

2.2.5.13 PBL enhances critical thinking and analytical thinking skills. PBL enhances critical thinking (Capraro & Jones, 2013; Capraro & Slough, 2013; Tretten & Zachariou, 1995) and analytical thinking skills (Boaler, 1999; Capraro & Slough, 2013). According to Markham (2012), PBL is “an extended learning process that uses inquiry and challenge to stimulate the growth and mastery of skills” (p.x.). As well as developing inquiry skills (Özel, 2013), it also aids teaching decision making (Thomas, 2000), provides knowledge application and contextualization of learning (Bell, 2010; Helle, Tynjala & Olkinuora, 2006) and promotes self-directed (Thomas, 2000) and independent learning (Bell, 2010).

2.2.6 Disadvantages of PBL. Student-centred disadvantages include higher time demands (Frank, Lavy & Elata, 2003), not being familiar with group work, problems with team members who give less effort in group work (Fragoulis & Tsiplakides, 2009; Mills & Treagust, 2003), and non-linguistic demands of projects (Fragoulis & Tsiplakides, 2009) whilst disadvantages of PBL related to teachers comprised of time constraints for developing, implementing and administering PBL curricula (Capraro & Jones, 2013; Helle, Tynjala & Olkinuora, 2006), demanding a great amount of preparation and classroom management skills from the teacher (Hutchinson 1991, p. 16), students’ lack of experience in more active learning roles and their negative reactions to change (Capraro & Jones, 2013; Frank, Lavy & Elata, 2003), teachers’ content knowledge (Capraro & Jones, 2013), group grading and assessment and measuring the contribution of each team member (Kilpatrick, 1921). On the other hand, institutional and organizational challenges consisted of focus on too many goals (Frank, Lavy & Elata, 2003), increase on the education cost (Dym et al., 2005), faculty resistance to changes (Mills & Treagust, 2003), and limited number of faculty members for applying these teaching methods (Mihic’ & Završki, 2017).

2.3 Integrating PBL into Language Education

For more than three decades, PBL has been promoted as an effective method for encouraging intentional language acquisition (Beckett, 2005; Fried-Booth, 1986; Haines, 1989; Legutke & Thomas 1991; McPherron & Randolph 2013; Poonpon, 2018; Stoller 2006; Stoller & Myers 2020). Grounded on the reviewed literature, there have been a number of studies that focus on the effects and implications of PBL on EFL students' language skills. Among these, while some of them concentrated on the student views and teacher perceptions on the use of PBL for enhancing language skills in an EFL and ESL context, others specifically focus on the effects of PBL implementation and in-class and out of class practices in EFL to foster language skills of learners. In this regard, there have been various studies examining the role of PBL for developing L2 learners speaking skills (Cong-Lem, 2018; Torres & Rodríguez, 2017; Wahyudin, 2017; Yaman, 2014), writing skills (Aghayani & Hajmohammadi, 2019; Praba, Artini & Ramendra, 2018; Sadeghi, Biniaz & Soleimani, 2016), reading skills (Kavlu, 2015; Rocha, 2017), and vocabulary learning (Kimsesiz, 2017; Nasser, 2015; Reisi & Saniei, 2016).

2.3.1 Research on PBL in EFL context. For the scope of this study, research regarding the students' and teachers' attitudes on the use of PBL in various context are presented initially. Following, PBL practices to enhance students' language skills and development are outlined.

Regarding the students' perceptions in high school level, LaPrad and Hyde (2017) conducted a single-case, qualitative inquiry study to examine the implications of PBL in a public high school and concluded that projects that are authentic tools for mastery of a learner. In the same vein, Duman and Yavuz (2018) sought the effect of PBL on high school students' attitude towards English classes with a quantitatively designed research in Turkey. According to Duman and Yavuz (2018), within groups of 5 and 6, students created projects on topics "the Design of Life in the 3000s Considering the Speed of Developments in Technology, Education System in the 3000s, Health Services in the 3000s, Economy in the 3000s, Smart Houses in the 3000s, Means of Transportation in the 3000s" (p.188). The results revealed a significant difference between the experimental and control groups' post-test results

in favour of the experimental group. Lastly, Susanti, Retnaningdyah, and Trisusana (2020) conducted a mixed-method study to examine the students' perceptions toward the implementation of PBL in a vocational high school in Indonesian EFL context. The students as groups with 3-4 members created three projects including "a video, an invitation letter and a wall magazine" in 3 months (Susanti, Retnaningdyah & Trisusana, 2020, p.117). The findings revealed that the teacher had a positive experience implementing PBL in EFL and recommended it as an effective and motivating way to learn English for students. Moreover, the students claimed to be pleased and enthusiastic during PBL process.

In terms of the students perceptions' on PBL in tertiary level, Beckett and Slater (2005) carried out a study in three classes at Canadian University to explore the implementation of PBL and examined undergraduate ESL students' perceptions on this implementation during 14 weeks. The participants included 57 students and their teacher. The data was collected through the syllabus, lesson plans, the teacher's and students' reflections, weekly portfolios, and interviews. The findings indicated that the students successfully achieved the goals for the project assignment. Moreover, PBL was found out to be helpful and facilitative to learn language, subject matter, and skills.

In another study, Tims (2009) examined the adult ESL students' perceptions on PBL in ESL context. Qualitative data was collected through in-depth phenomenological interviewing with 20-47 aged six advanced ESL students. PBL was found to assist ESL adult students develop, acquire, and/or practice English since it allows for hands-on learning and the integration of the four language skills. Students stated that project work pushed them to become more confident speakers. On the other side, several students complained that working on projects was a waste of time and that they wished an emphasis on a specific grammatical point or ability. Students also said they didn't have enough time to complete the project work and that they required more instructor interaction while working on their projects.

In a parallel Study, Gibbes (2011) examined thoughts of 191 college students on PBL and whether PBL is effective for acquiring a language through questionnaires and semi-structured interviews. It was found out that a majority of the learners had positive

perceptions on project work. 58% of the students indicated strong support for PBL as a fun and helpful method in enhancing linguistic and non-linguistic skills. The learners' proficiency level was a predictor, which effected their responses as beginners overall more receptive to PBL compared to advanced learners.

In the same vein, Petersen and Nassaji (2016) investigated and compared ESL teachers' and learners' beliefs and attitudes toward PBL. Data were collected from 118 participants through questionnaires and interviews. Results indicated that both teachers and students expressed positive attitudes toward projects in language classrooms and pointed out several advantages of PBL compared to conventional language teaching methods.

Furthermore, Avşar (2017) investigated English teachers' and students' views towards PBL. The participants included 100 teachers and 100 students selected with convenient sampling method in 2016-2017 academic year in Kırşehir, Turkey. The data was collected through two different questionnaires to find out students' and teachers' views on PBL in ELT. The results indicated that teachers and students do not have sufficient knowledge and competence on PBL and therefore PBL is not applied so efficiently as to catch up with the necessities of the increasingly changing era. In conclusion, it is suggested that PBL would be more successful and effective if the instructors themselves are educated for that approach and directed to discard traditional ways of education.

In another study, Mihic' and Zavrski (2017) explored the advantages and disadvantages of PBL. While the students' opinions were collected through an online survey, the professors' opinions were gathered through semi-structured interviews and a questionnaire. The results of the study show that students mostly acknowledge all of the benefits of PBL. In line with this, teachers expressed design experiences, increased motivation, development of engineering thinking, and knowledge application and contextualization as the most important advantages the most significant disadvantages were claimed as the shortage of faculty members, faculty resistance to changes, requirement of interest cooperation and institutional support and hierarchical knowledge structure.

Adams (2018) also conducted an empirical mixed-method study to investigate teachers' and students' perception of PBL in a Guatemalan EFL context via four-week group project entitled "EcoDream", which included activities based on recycling, trash, climate change, and sustainable development. The participants consisted of a teacher and 18 students. The results of surveys, an interview, and observation revealed that not only the teacher but also the students considered the project as an effective way to learn and teach English.

Essien (2018) examined the effectiveness of PBL on English major students' L2 and their perceptions of PBL in Thai Context. The participants included 81 English major students in Bangkok. Data obtained from t-test and the questionnaire indicated positive effects of PBL on students' English language ability. Majority of the students reported that PBL has improved their critical thinking ability, independent study skill, responsibility and communication skills.

On the other hand, some of the studies found out negative student perceptions of PBL. Eyring (1989) conducted a study with 11 learners from Latin America, Asia, and Europe. As part of the PB English language course, the students picked their own themes, planned, researched, wrote, and presented them. Despite the fact that the projects were completed successfully, the college learners did not offer PBL a positive assessment. The students questioned the procedure, stating that allowing so much involvement and authority in an academic setting was inappropriate. They also voiced a wish for a return to conventional learning methods and desired more grammar teaching. In addition, Beckett (2005) conducted a longitudinal study in an ESL program in a Canadian secondary school and made interviews with 73 learners to find out their attitudes on PBL. The results revealed that "less than 18% reported enjoying project-based instruction; 25% reported having mixed feelings; and the remaining 57% perceived it negatively" (Beckett, 2005, p. 198). The students who appreciated PBL said it taught them how to think in English and gave them opportunity to enhance their research, computing, and presenting abilities in English. On the other hand, mixed feelings generally depend on their being in favor of the challenge within projects, the integration of skills they required, the lack of the time to finish projects, and hard work.

Considering particularly teacher perceptions on PBL, Tamim and Grant (2013) conducted a case explore in-service teachers' definitions of PBL. The participants included teachers from public and private schools. Data was collected by means of interviews and documents such as lesson plans and evaluation instruments. The results obtained from inductive analysis and constant comparative method indicated that teachers defined PBL through its perceived advantages on learning and they adopted student-centered approaches in PBL. In conclusion, teachers found PBL as a supporting and facilitating method for the learning process, improving creativity and collaboration of the students, increasing motivation and engagement.

In another study, Harris (2014) also investigated middle school teachers' perceptions on the implementation of PBL and examine the challenges teachers come across while implementing PBL, the ways they respond to these challenges, and the role of 21st century skills in PBL. A perception questionnaire administered to forty-nine teachers revealed that "the teachers perceived time, meeting standards, meeting accountability expectations, implementing within the school's schedule and design were most challenging" factors while implementing PBL (Harris, 2014, p.96). It is concluded that 21st Century skills is significant for PBL implementations and need to be addressed during PBL process.

There have been variety of studies investigated the PBL practices to enhance students' language skills and development.

Foss et al. (2008) examined the short term effects of PBL via seven-day intensive English program for 65 Japanese university EFL students. The students created The Wikipedia, The Newspaper, The Small-Groups Video, and The Whole-Group Video Project. The results indicated that PBL was a beneficial and successful method to prepare students for real world events and develop their EFL skills at the same time.

Li (2010) also carried out an experimental study with 183 university students who accomplished a ten-week semi-structured project in the place of the scheduled oral class. The results indicated that "the project group outperformed the non-project group in listening comprehension, vocabulary, and English exam, but not in reading

or writing. Findings from questionnaires revealed positive evaluation of self-improvement and practical application of English” (Li, 2010, p. 105). However, the findings also revealed some negative feedback such as “insufficient time for speaking English and instruction being too difficult to understand” (ibid., p. 106).

Baş (2011) studied the effects of PBL on 60 high school students’ L2 academic achievement in English lesson in Turkey. The results of the pre and post-tests revealed that there was a statistically significant difference between the attitude scores of the experiment group and the control group. In addition, PBL was found to be more effective in enhancing the students’ academic achievement and the students trained by PBL had higher academic achievement and attitude levels towards the lesson compared to their peers in the control group.

Furthermore, Nassir (2014) conducted an experimental study to scrutinize the effectiveness of PBL strategy on developing 76 ninth graders’ achievement level in English and their attitudes towards English. The results through the analysis of pre-post achievement test, an attitude scale and speaking evaluation card indicated that there were statistically significant differences in favor of the experimental group’ four skills, grammar and vocabulary.

In line with these, Pinzon Castenada (2014) also investigated whether the implementation of the PBL aids to increase English skills of high school students in Boyacá. The students were expected to work collaboratively and accomplish a project entitled “The Wonderful World of the Fruits” which was based on preventing the food waste. According to Pinzon Castenada (2014, p.162), “the project stages included getting started, the field work, and culminating/debriefing events”. Data collected through interviews and artifacts indicated that students were motivated to learn English, remember vocabulary items when actively involved and the relationship between student and teacher was strengthened.

Poonpon (2018) also explored the implementation of PBL in a language course of Information Science to facilitate their four skills of English in Thai context. The group projects include “a website on digital libraries, creation of a TV program about the role of Information Science in their daily life; presentation of a stage performance

reflecting the negative effects of Information Science on Thai families” (Poonpon, 2008, p.4). The 47 undergraduate students’ interviews concluded that the implementation of the interdisciplinary-based group project was appropriate as they can apply their knowledge while carrying out the project. They also revealed that it gave them opportunity to improve English skills in real life contexts.

Regarding the effects of PBL on affective aspects, Doppelt (2003), for example, conducted a continuous field research for exploring 54 high school students’ progress in the affective and the cognitive domains in Israel. Data was collected via portfolios, observations, interviews, achievements in examinations, and assessment of projects. Analysis showed that scientific-technological PBL enhanced students’ motivation and self-image and promoted affective learning.

In a parallel study, Shin (2018) explored the effect of PBL on 79 students’ motivation and their self-efficacy. After a collaborative video production projects, data collected through questionnaires illustrated that PBL has a positive influence in students’ motivation in EFL learning process and enhance their cooperation skills. It is concluded that students’ participation in PBL using technology has motivated them to learn English eagerly and effectively.

In another study conducted by Pham (2019) whether PBL increased the motivation of elementary level 30 first-year non-English major EFL students during two-semesters was examined. The results obtained from the interviews indicated that students were in favor of PBL activities at the end of the implementation. In conclusion, two-semester experience with PBL provided students room to develop their autonomy and increase their motivation while learning English.

In terms of the influence of PBL on vocabulary development of learners, Yıldız (2009) examined the difference between the traditional method and PBL in the vocabulary achievement of 48 secondary school students in Turkey. After the 4-week treatment period, which included studying the target words through projects, pre and posttest analysis revealed that there is a significant difference in favor of experimental group students’ vocabulary achievement scores.

In line with this, Kimsesiz (2017) examined the effectiveness of PBL in teaching English vocabulary to children in preschool education and compare PBL to traditional methods with a mixed method study. The participants included 28 children attending to pre-primary schools in Bayburt and Kayseri, 30 head masters of pre-primary schools, 150 English language teachers who teach to pre-school children and 56 parents whose children learn English at preschool period. The findings illustrated that mostly traditional methods and techniques are used in teaching English to pre-school children in Turkey and there is not a systematic and consistent English teaching at pre-primary schools in Turkey. However, teaching English vocabulary to preschool children via the use of 8-week PBL activities including a paper aquarium or an animal farm made of play-dough and presenting it to the class is found out to be more effective in teaching rather than the use of more traditional techniques. Additionally, it is indicated that most of the parents who took part in the study are in favor of English teaching at pre-school period. In conclusion, the results of the study revealed the effectiveness of PBL in teaching English vocabulary to preschool children.

In a parallel study, Kettanun (2014) investigated the effectiveness of PBL in a Thai EFL classroom at Bangkok University. The projects included “an investigative report on a social issue, a feature story, a sales message, and a situation comedy” (Kettanun, 2014, p.569). Data of 21 students was collected through pre- and post-tests, journals and interviews revealed that the PBL fostered positive learning outcomes in EFL classroom and developed students’ cognition, work ethics, and interpersonal skills, as well.

Hoose (2017) also investigated the effectiveness of PBL in teaching advanced level ESL students locating, evaluating, and using evidence from texts with a classroom based mixed-method study in the USA. Data collected through assessments, text analysis, surveys and teacher field notes and observations illustrated that PBL fostered students to learn academic skills. These results were in line with Alan and Stoller’s (2005), Finn Miller’s (2010), and Stoller’s (2006) studies indicating ESL students’ increasing motivation, engagement, research abilities, critical thinking skills, and content knowledge. In addition, survey results and teacher observations indicated

that the participants were found to be enthusiastic about the PBL.

Hudiananingsih et al. (2019) investigated the effectiveness of PBL toward students' achievement. The participants consisted of two groups of students majoring in accounting who had same English level of ability and received "a three-session English learning with discussing topic of making complaint" (Hudiananingsih et al., 2019, p.379). In that sense, students of both groups were assigned to make a dialogue with members of their group. Their performance in front of class was assessed via assessment rubric. In addition, they were assigned to make written complaint. When the results of the experiment and control group was compared, it is indicated that there was a slight increase in score of the experiment group. However, it is suggested that the slight increase in score between control group and experiment group could be because of some factors, such as length of study, short preparation toward realization, and students' difficulty in searching knowledge and unfamiliarity with procedure.

In line with this, Sampurna (2019) conducted a qualitative study to examine the use of multiple Web 2.0 technologies such as Facebook, WhatsApp, Google Docs, and LINE within PBL to enhance English learning practices beyond the classroom in Indonesia. Data obtained through research diary, learners' reflections, and interviews indicated that obstacles included language anxiety and technological issues whilst benefits consisted of form-focused instruction, peer review, interaction in the target language, and collaborative dialogue. 21 undergraduate level learners' feedback indicated both positive and negative views on their online non-formal PBL experiences. However, all learners still agreed to benefit from PBL in different ways.

Regarding the advantages and disadvantages of PBL implementation especially in EFL, Kavlu (2017) conducted in-depth interviews and found out that students developed their language and social communicative skills as PBL implementation shifted them from the standard monolog classroom to modern real-life context facilitating analytical thinking. Concerning the application of PBL, it was pointed out that their learners increased English language skills as well as organization and presentation skills. In that sense, PBL was recommended to provide innovative English language acquisition in terms of equipping learners with necessary 21st century skills

at the same time.

In order to explore the forms, effects, and challenges of integrating PBL into English for Academic Purposes (EAP) teaching in the Chinese context, Li and Wang (2018) conducted an ethnographic approached study and specifically investigated how the PBL pedagogy was integrated with the EAP course. The results revealed that collaborative research projects were found out to be useful in improving the students' academic English, disciplinary knowledge, autonomy, interpersonal ability and teamwork skills. On the other hand, concerning the implementation of the PBL pedagogy in EAP teaching, several challenges were discovered including the EAP teachers' limited disciplinary knowledge, the limited resources for conducting student-led projects, and restricted opportunities for the dissemination of the students' research outcomes which need to be addressed carefully to ensure the success of the PBL EAP course.

Lastly, Nuñez (2018) conducted a mixed method study to examine the implementation of PBL in improving science instruction for ELs in high school classrooms for identifying teachers' opinions and advantages to English learners. Data collected by means of pre-post student and teacher surveys, interviews, observations, documents and physical artifacts revealed that academic engagement, mentality, confidence, sense of belonging, and problem-solving abilities have all benefited ELs as a result of PBL. Furthermore, the implementation of PBL by the participating instructors resulted in significant changes in their attitudes of curricular design and preparation for ELs.

Until this point, descriptive PBL studies on students' perceptions and experimental PBL studies for enhancing overall language skills of EFL learners are outlined. However, these previously mentioned studies do not focus on specific language skills of learners. On the other hand, there have been other studies in the reviewed literature, which specifically concentrated on the PBL practices to improve EFL learner's productive skills in different levels. For this reason, research on PBL and L2 writing, and then L2 speaking is presented in the following section.

2.3.2 Research on PBL and L2 writing skill. Due to the problem-solving aspect of writing and the attention learners pay to language usage and processing, writing plays an important role in facilitating language learning (Byrnes & Manchon, 2014). Developing learners' writing skills in L2 has been a concern in tertiary education for a long time (Jordan, 1997). Writing in English for academic purposes is a skill taught in undergraduate programs in Turkey; nonetheless, research on L2 writing has indicated that Turkish language learners consider writing to be the hardest language skill to master (Abdel Latif, 2007; Kurt & Atay, 2007; Sağlam, 1993) as it is considered to be an extremely difficult skill, even in one's native language (Nunan, 1999). In this regard, few researchers investigated the effects of PBL on EFL students' productive skills and found out that PBL had a significant effect on students' English writing skill and revealed that it promoted students' critical thinking, communication, and creativity through collaborative work (Praba, Artini & Ramendra, 2018) and improved enthusiasm, confidence, creativity, self-directed learning and collaborative learning skills (Astawa, Artini & Nitiasih, 2017). In that sense, this study also concentrates on PBL to improve L2 writing skills and 21st century skills of EFL learners in an integrated way.

Grounded on the reviewed literature, there have been a number of studies that focus on the effects and implications of PBL on students' L2 writing skill. Among these, while some of them tried to find out the outcomes of PBL instructions to foster L2 writing skills of students in secondary (Alotaibi, 2020; Baidya, 2019), high school (Chikita, Nyoman, & Wayan, 2013; Praba, Artini, & Ramendra, 2018; Arihastha & Basthomi, 2019) and colleges (Affandi & Sukyadi, 2016; Aghayani & Hajmohammadi, 2019; Irawati, 2015; Sadeghi, Biniiaz, & Soleimani, 2016; Sa'diyah & Cahyono, 2019; Sukmawati, 2020; Thitivesa, 2014), others also focused on the student views and perceptions (Grant, 2017; Syarifah & Emiliasari, 2019) towards the use of PBL for the development of L2 writing skills in EFL context. Within the scope of this thesis, studies conducted in tertiary level are presented in detail whilst the ones in secondary and high school context are outlined briefly.

Regarding the secondary school level, Alotaibi (2020) examined the effect of PBL on persuasive writing skills of Saudi 59 EFL secondary students and found out

that participants' level of persuasive writing performance was found out to be significantly developed upon receiving PBL. In a similar vein, Baidya (2019) explored the effectiveness of PBL to improve L2 writing skills of 16 lower secondary students in Bangladeshi context and end-product evaluation indicated that PBL is a highly effective method in English language writing skill development and the learners were found out to rely on technology during the information gathering, processing and self-researching period, which fostered the learning outcome. It was concluded that an effective language learning through PBL project can be ensured by proper planning of the PBL, careful selection of learning goal in relation to the learners' age and learning through class discussions, peer-talk, digital resources, and technology integrated PBL activities. Within high school context, Chikita, Nyoman, and Wayan (2013) conducted an experimental study to explore the effect of PBL on writing competency of 80 eleventh grade students and revealed that PBL has a significant effect for both high and low discipline students. Praba, Artini and Ramendra (2018) also explored the effect of PBL on 32 ninth grade students' writing skill with a mixed method design study and suggested that PBL enhanced students' critical thinking, communication, and creativity through collaborative work. In addition, Arihastha and Basthomi (2019) specifically aimed to improve the 39 high school students' ability in writing hortatory exposition text with a collaborative classroom action research and concluded that PBL integrated with process writing and Instagram aided to improve the students' writing achievement.

Regarding the tertiary level, Thitivesa (2014) examined "the use of project work as a pretext for applying the conventions of writing, or the correctness of mechanics, usage, and sentence formation, in a content-based class in a Rajabhat University" (p.2883). 38 English major students' achievement test and writing works indicated that the students succeeded more in mechanics and usage, yet less in sentence formation. In terms of communication, students concentrated on conveying their message and applying knowledge of conventions to their writing at the same time.

Furthermore, Irawati (2015) conducted a descriptive qualitative research to examine the application of PBL to develop 20 English Department students' ability in academic writing class. Upon working in groups of 4-5 people in 6 weeks to make a

cultural project in the form of essay, creating a mini-journal from them, and presenting in front of the class, students were found to have better academic writing in terms of content and vocabulary. As a result, the students became more independent and critical while the lecturer became more aware of the students' writing development via only monitoring and checking their process.

In terms of the effectiveness of PBL at the tertiary level, Affandi and Sukyadi (2016) examined the 78 participants. The data was collected by means of the writing argumentative texts as pre and posttests and interviews to find out students' attitude toward the use of PBL. The findings suggested that PBL developed the students' writing achievements and was claimed to be an interesting method that enabled high, mid and low achievers to think contextually and exploratively for solving problems.

With a parallel study, Sadeghi, Biniaz and Soleimani (2016) investigated the impact of PBL on comparison and contrast paragraph writing skills of 36 intermediate level Iranian EFL learners. Following the 10 weeks of PBL instruction, a comparison and contrast paragraph writing post-test results indicated that the experimental group students who were educated by PBL outperformed the students who were taught through the student textbooks based instruction. The findings revealed the positive impacts of PBL in increasing students' L2 writing performance.

Furthermore, Aghayani and Hajmohammadi (2019) investigated the effect of PBL on 28 Iranian EFL learners' persuasive essay writing skill. Following two-month treatment, PBL was found to have significant effect on the experimental group of learners' writing ability in a collaborative environment. In addition, PBL was asserted to increase students' willingness in language learning.

In another study, Sa'diyah and Cahyono (2019) examined how PBL through blogging affects the writing ability of 41 EFL college students across self-efficacy levels in Indonesia. PBL through blogging in the argumentative writing class was applied on the experimental group. The data collected through writing tests and self-efficacy questionnaires illustrated that the students using PBL through blogging got better scores in writing compared to the ones taught via traditional method.

Lastly, Sukmawati (2020) conducted an exploratory action research to examine whether the PBL intervention is able to improve the 30 Indonesian university students' skill in writing a descriptive text. The students were expected to write a composition about information technology. Data conducted by means of an open-ended questionnaire, a writing test and open-ended interview. The results indicated that PBL activities enhanced the students' engagement and an increase in their average scores.

Regarding the students' perceptions of PBL on L2 writing skills, Grant (2017) examined the development of a PBLT project in Asian EFL context and investigated the implementation and student perceptions of this project within an EAP writing course in Macau. Findings obtained via student questionnaire and teacher reflections revealed that the project was effective for creating opportunities for meaningful interactive language use, and students were comfortable with their autonomous role within the project process. In addition, students were found out to be eager and active in looking for corrective language feedback. Results suggested that student motivation, autonomy and learning opportunities increased through the PBLT approach. Moreover, as suggested by Grant (2017), the project provided some opportunities in terms of student interaction, authentic and meaningful language use, formative and summative assessment.

Lastly, Syarifah and Emiliasari (2019) examined the use of PBL to develop ELT students' abilities and creativity in writing narrative text and the students' perception towards the implementation of PBL in writing course. The data obtained through field note, final product of the project, and interview revealed that PBL facilitated creativity in writing narrative text in terms of their understanding of the topic, structure of text, and language feature. Furthermore, the students reported to learn networking, collaborative learning, and teamwork through PBL.

As aforementioned, both the descriptive and experimental studies related with PBL and L2 writing skills have been presented up to now. In line with this, studies conducted with the aim of integrating PBL and L2 speaking as another productive skill, are outlined in the following section.

2.3.3 Research on PBL and L2 speaking skill. As suggested by Khamkhien, (2010), “Speaking, as a productive skill, seems intuitively the most important of all the four language skills because it can distinctly show the correctness and language errors that a language learner makes” (p.184). However, speaking is the most difficult skill to master since it necessitates the mastery of sub-skills in speech production such as vocabulary retrieval, grammatical pattern selection, and sociocultural competence (Bailey & Savage 1994; Celce-Murcia & Olshtain, 2000). Additionally, speaking becomes more difficult for EFL learners who do not have the chance to practice English outside of the classroom in real-life contexts (Uztosum & Erten, 2014). Grounded on this, there have been a number of studies conducted in EFL context to promote L2 speaking skills and oral communication competences of learners by means of using communicative games (Dewi, Kultsum & Armadi, 2017), dialogic teaching (Elhassan & Adam, 2017; Gupta & Lee, 2015), drama (Akyüz & Tanış, 2020; Belhan, 2014; Kılıç, 2009; Nuktong, 2010; Saygılı, 2014), debates (Firmansyah & Vegian, 2019; Widyaningsih, 2016), storytelling (Ikrammuddin, 2017; Zuhriyah, 2017), brainstorming (Lince, 2013; Srihandayani & Marlina, 2019). However, this study aims to utilize ICT-Assisted PBL to develop L2 productive skills of EFL learners as well as their 21st century skills which global world seek for in a great demand.

There have also been a number of studies that focus on the effects and implications of PBL on students’ L2 speaking skill in different levels including high school (Astawa, Artini, & Nitiasih, 2017; Astawa, 2018; Dewi, 2016; Kaunang, 2017; Torres & Rodríguez, 2017) and tertiary education (Anuyahong, 2018; Bakar, Noordin & Razali, 2019a; Dewi, 2016; Ekizer, 202; Kamisah, 2013; Rochmahwati, 2015; Rustan, 2016; Sirisrimangkorn, 2018; Wahyudin, 2017). Majority of these studies tried to find out the outcomes of PBL instruction to foster L2 speaking skills and oral production of students, whilst only Yaman (2014) focused on the student attitudes towards the use of PBL for the development of L2 speaking skills. As aforementioned, in relation to the aims of this thesis, studies conducted in high school environment was outlined briefly while the tertiary level studies were presented in detail.

Regarding the PBL implementation in high school context, Dewi (2016)

conducted an action research to explore the application of the PBL through group work in teaching English specifically for a speaking class. Data collected through the observation sheets, tests, and questionnaires showed an increase on the researcher's participation, the students' participation, and speaking skills of the students. In line with this, Astawa, Artini and Nitiasih (2017) conducted a mixed-method study on the effect of PBL on students' English Productive Skills in a junior high school in Bali-Indonesia and revealed that the students found PBL as an effective approach to improve enthusiasm, confidence, creativity, self-directed learning and collaborative learning skills while it was claimed to promote teaching motivation and satisfaction by the teacher. In line with this, Kaunang (2017) conducted an action research to enhance 25 high school students' speaking skill via using PBL and found that PBL developed the students' speaking skill and therefore suggested as an effective method in teaching speaking skill. In another study, Torres and Rodríguez (2017) also explored ninth graders' speaking skills improvement in an EFL classroom through PBL and asserted that PBL increased oral production via lexical competence development and decreased students' fears of speaking in L2. Furthermore, Astawa (2018) conducted a mixed-method study on the impacts of PBL on Indonesian junior high school students' speaking skills, engagement and how 10-week activities enhance students' learning process and revealed an enhancement in students' critical thinking skill, creativity, communicative, and collaborative learning ability.

Considering the implementation of PBL in tertiary education, Kamisah (2013) for example, conducted a classroom action research with 44 students to improve their speaking skill through PBL. The findings gathered through observation and interview revealed that the students' speaking skill increased through PBL and students found PBL as an effective and were interested in PBL activities which promotes class participation and active engagement of the students within peer activities. Lastly, the results illustrated that real life topics activated students' background knowledge as the students made connections to the situation and use many words or phrases in order to activate their prior knowledge. These PBL activities were recommended to increase critical thinking of the students. To conclude, the result of research indicated that PBL improved students' speaking skill.

In the same vein, Rochmahwati (2015) investigated the effect of PBL toward speaking ability of 70 English Department students with a sequential designs study. The students were expected to perform 4 different projects including “a presentation of a fairy tale, legend or fable with a puppet; oral presentation on how to make a traditional food; telling the story of an Unforgettable Holiday with picture series; and drama performance” (Rochmahwati, 2015, p.212). The result of tests revealed a significant effect of PBL toward students’ speaking ability while observation and interviews revealed positive attitudes toward the use of PBL in speaking class.

In a parallel study, Rustan (2016) examined the effect of PBL to improve students’ speaking skill and tried to answer to what extent is PBL effective in improving speaking skill of 34 Cokroaminoto Palopo University students. The students, within project groups, were expected to design, create, and present a small toy robot. Pre and post test results indicated that Biology students’ speaking skill increased by the PBL. It was revealed students became more active and less shy in speaking.

In a parallel study, Wahyudin (2017) conducted an experimental study for a semester to find out whether the 60 undergraduate ESP students’ L2 oral performance in English for Business Class is significantly affected after PBL. The students created a project video and a business presentation. The findings of the oral test revealed that the PBL students outperformed the traditional class students.

Concerning the impacts of using PBL approach to enhance English speaking ability of 60 Thai undergraduate students, Anuyahong (2018) investigated their satisfaction with PBL with an experimental study. According to Anuyahong (2018, p.76), “projects organized in this study were Storytelling, English news report and Teenager Guides were unified with project steps”. After the creation of these three team work speaking projects within 12 weeks and presenting them, the students’ speaking achievement was found out to be higher in each project respectively.

On the other hand, Sirisrimangkorn (2018) examined how the use of PBL within drama promotes EFL learners’ speaking skills. Analysis of quantitative and qualitative

data revealed that learners' speaking skills were increased using PBL focusing on drama. In addition, drama-based PBL is found out to be encouraging for promoting learners' language learning, speaking skills, and affective factors. The results of the study indicated that PBL focusing on drama is not only an effective teaching method providing learners with opportunities to speak English but also an enjoyable way for learners to learn a foreign language in a communicative context.

Bakar, Noordin, and Razali (2019a) conducted a quasi-experimental study to examine the effectiveness of using PBL in improving the oral communicative competence of 44 Malaysian EFL learners enrolled in a Communicative English Course. After the 12-week PBL implementation including eight different PBL activities, findings obtained via speaking and listening pre and posttest and a student questionnaire illustrated a significant improvement in the learners' overall oral communicative competence and a high perception of PBL by the students. Therefore, PBL is recommended for low proficient English learning technical students.

In a more recent study, Ekizer (2021) aimed to explore the effects of PBL on the speaking skills of ELT department students in Turkish EFL context. To reach this goal, "Four projects including Class Newspaper, A Movie Poster, Surveys, New Inventions were carried out within groups of 4-5 during the term" (Ekizer, 2021, p.1065). Results obtained through Semi-Structured Interview and Focus Group Discussion revealed that PBL increased spoken fluency levels and decreased their anxiety.

Lastly, regarding the student perceptions of PBL on L2 speaking, Yaman (2014) conducted an experimental study to examine the efficacy of PBL on college students' attitudes and achievements in speaking in Turkey. The results of the speaking posttests indicated that PBL is effective to develop speaking skills of students. Also, a statistically significant difference was found in favor of PBL group of students.

However, while implementing PBL, different tools could be integrated into the design, application, and presentation process of projects. As ICT tools and emerging technologies have been widely used in education with regard to constantly developing

technologies, PBL instruction benefited from the advantages they provide, as well. Grounded on this, ICT assistance in PBL is presented in the following section.

2.4 ICT Integration in PBL

According to Chai and Kong (2017), “the emergence of the current technology-driven world has raised many challenges to didactic teaching and learning in traditional classrooms” (p.1). Therefore, educators are required to reconceptualize the things necessary to be learned and how this would be accomplished. As a forementioned, these inquiries have resulted in transformation of education which teacher centered, knowledge transmissive models have been replaced with student-centered, transformational models that focused on student interaction and benefited from “ICT as tools for “knowledge construction and co-construction” (Chai & Kong, 2017, p. 1).

PBL, as an innovative method, is also more effective when supported with educational technology (Stites, 1998; Marwan, 2015; Prensky, 2018). In comparison to the typical “stand and deliver” classroom atmosphere, an ICT-Assisted PBL teaching and learning context can give an authentic, contextual learning, constructivist, multidisciplinary, cooperative learning environment (University of Oregon, 2019). For this reason, this study focuses on integrating emerging technology tools within PBL with the aim of developing students’ not only L2 productive skills but also 21st century skills with an interconnected approach.

However, there has been limited number of studies that focus on the implementation and effects of specifically ICT-Assisted PBL on students’ language skills in EFL context (Kato, Spring & Mori, 2020; Marwan, 2015; Santhi, Suherdi & Musthafa, 2019; Sawitri, 2012).

Sidman-Taveau (2005) investigated the implementation of Computer-Assisted PBL with 27 adult ESL students and their teachers within case studies. The results indicated that learners enhanced independence, higher order thinking, and electronic literacy skills together with specific English language skills and language learning strategies. Computer-Assisted PBL was suggested as providing a rich target language input and output and linguistic development opportunities for students. For instance,

students learned to use idioms and newsletter language, improved their writing considering language, content, grammar, and mechanics. Furthermore, the results showed that while writing articles for projects, students could listen actively and comfortably, and talk more smoothly.

Sawitri (2012) also conducted a quasi-experimental study to investigate the impacts of ICT-Based PBL on the writing competency of sophomore students. The results obtained through questionnaire and test indicated that, ICT-Based PBL had a significant impact on students' writing competency as ICT-Based PBL group had higher writing competency compared to the traditionally lectured group. Additionally, self-directed learning and ICT-Based PBL were found to be interrelated.

In an action research, Marwan (2015) also implemented PBL with ICT in an English classroom to empower 25 higher institution students' English. Following the three projects within six-weeks, interviews and observations indicated that students experienced a more meaningful English learning and become highly motivated when exposed to PBL. Moreover, the findings revealed that PBL with ICT provided positive gains for teacher's pedagogical and technological beliefs. Therefore, teaching with PBL and ICT was recommended to experience a positive change in student's learning English.

Furthermore, Santhi, Suherdi and Musthafa (2019) conducted a descriptive qualitative research to examine the technology-based English learning of 35 Indonesian high school students. After five sessions of PBL, students uploaded videos to YouTube as the final products. They reported learning using PBL to be challenging, motivating, engaging, enhancing their English, and increasing their creativity. In conclusion, implementation of PBL integrating ICT is recommended for EFL teachers.

Lastly, Kato, Spring and Mori (2020) conducted a quasi-experimental study to investigate the outcomes of a video-synchronous learning program in which PB was integrated to foreign language learning. Via cooperatively creating a homepage during computer-mediated learning session, intrinsic motivation and target language oral abilities were aimed to be developed. Pre- and posttests and reflection papers indicated

a strong indicator of increased speaking ability. In addition, their motivation levels increased after PBL.

In addition to the previously mentioned EFL studies, there have been different field of studies integrating ICT-Assisted PBL to develop industrial experience of learners (Gibson, O'Reilly & Hughes, 2002), nano knowledge and learning skills (Yang, Cheng, Chang, Chen & Li, 2014), communication, thinking, problem solving, and applying life skills capabilities (Soparat, Arnold, & Klaysom, 2015), early literacy (Valova, 2016), ICT integration skills (Pilten, Pilten & Sahinkaya, 2017), and mathematical skills (Abdullah, Nani, Hamid & Jalal, 2018). These different field of studies also evidenced the positive outcomes of ICT-Assisted PBL on students' development in various subject areas including maths, science, ICT, life skills, and early literacy education.

Regarding the integration of ICT-Assisted PBL on different subject areas, initially, Gibson, O'Reilly, and Hughes (2002) examined whether ICT within a PBL environment provides students with the opportunity to work with emerging technologies and gain important industrial experience. The results of two case studies including a short project and a more substantial project that took place at undergraduate level revealed positive outcomes on software development. In another study, Yang, Cheng, Chang, Chen and Li (2014) investigated the effectiveness of ICT-Assisted PBL on college-level nano knowledge and learning skills. Upon 6 weeks of instruction, the pre and posttest results revealed that PBL improved students' understanding about nanotechnology and learning skills. It is also suggested that ICT-Assisted PBL provided nanotechnology knowledge and enhanced concentration, motivation, problem-solving and creative thinking skills. In a parallel study, Soparat, Arnold and Klaysom (2015) examined the use of ICT supported PBL to develop 212 Thai learners' communication, thinking, problem solving, applying life skills and technological application capabilities. The data obtained via lesson plans, students' journals, semi-structured interviews, and social networking where students' learning artifacts and products revealed that students were able to perform all of the capabilities. The research findings showed that the integration of PBL with ICT might help students improve their ability to communicate ideas, problem solve, develop life skills, and use

technology, as well as their learning in the content of subject matter. Different from other subject areas, Valova (2016) examined the integration of ICT into PBL to explore the development of communicative competence in the pre-schools. The findings of the study revealed that good quality text indicators like connectivity, organization, idiomatic, terminology-rich and meaningful connections, have significantly enhanced. These findings suggested that using online PBL encouraged the students to develop their technology skills in meaningful ways. In another subject area, Pilten, Pilten and Sahinkaya (2017) investigated the effects of ICT-Assisted PBL practices on ICT integration skills of 72 Turkish pre-service classroom teachers within a mixed method study. After the 12-week experimental procedure, ICT assisted PBL practices were found to have positive effects on ICT self-efficacy perceptions and ICT integration levels of pre-service teachers. In accordance with the aim of the recently mentioned studies, Kramer (2007) also examined the implementations on ICT-Assisted Collaborative PBL among international educators and found out that it is a practice that has lot of benefits in helping students to learn and acquire skills. Furthermore, Seet and Quek (2010) examined 68 secondary school students' perceptions of their computer-mediated PBL environment and their attitudes towards Project Work. The results indicated that students had favourable perceptions on the computer-mediated PBL environment. In a more recent study, Abuhmaid (2020) examined the efficiency of online learning environment for implementing PBL in tertiary level and found out strong positive attitudes among online students toward Project Based learning.

As illustrated in the previously mentioned studies, PBL has been used for various purposes, one of which is to improve language skills of the students. In addition, there have been other studies in the literature focused on the development of the learner autonomy by means of integrating PBL. To this end, learner autonomy in ELT and specifically research on PBL and learner autonomy are presented accordingly in the following section.

2.5 PBL and Learner Autonomy in English Language Teaching

One of the main objectives of PBL is to foster learner autonomy. Holec (1981) defines learner autonomy in language teaching as:

The ability to take charge of one's own learning... (and)... to have, and to hold the responsibility for all the decisions concerning all aspects of this learning like; determining the objectives, defining the contents and progressions, selecting methods and techniques to be used, monitoring the procedure of acquisition properly speaking (rhythm, time, place...) and evaluating what has been acquired (p. 3).

Little (1995, p.175) also emphasizes the link between taking responsibility and autonomy stating that “the basis of learner autonomy is that the learner accepts responsibility for his or her learning and successful learners have always been autonomous” and adds that “autonomy is a capacity for detachment, critical reflection, decision making and independent action” (Little, 1991, p.4). Nunan (1986) suggests that “language teachers must accept their learners as the owners of the skills needed to continue learning a language autonomously” (p.30). At that point, the teacher becomes “a provider of scaffolding, a role model, a guide, a motivator and a cheerleader” (Leaver et al., 2005, p.210-214). Therefore, teachers are required to support their students with necessary strategies to achieve their own learning objectives. Little (2007) indicated that “the development of autonomy in language learning is governed by three basic pedagogical principles: learner involvement, learner reflection and appropriate language target language use” (p.2). PBL comprises of these three main aspects of learner autonomy.

Grounded on the reviewed literature, there have been various studies that focus on the effects and role of PBL on learner autonomy in different levels including secondary school, high school and tertiary education in EFL context.

In the context of secondary education, Rahmani and Saddi (2016) conducted a mixed method study to investigate the development of Algerian secondary school learner's autonomy through the PB approach to English language learning. The results obtained via questionnaires indicated that EFL learners are autonomous while preparing their project.

In a parallel action research, Pichailuck and Luksaneeyanawin (2017) investigated how PBL can enhance LA of 6th grade Thai EFL learners. Data collected

via field notes, interviews, diaries, observations and assignments revealed that all students were receptive to PBL and LA enhancement. In that sense, PBL was suggested for teachers to make the most of existing resources to gradually increase LA in young EFL learners, which fosters higher academic achievement.

In line with these, Dewi, Marhaeni and Ramendra (2019) also examined the effect of PBL on speaking skills of 82 eighth grade students. The data obtained through learner autonomy questionnaire and speaking performance test revealed that there was difference between the students taught by using PBL and those taught by using conventional method in in favor of the PBL group excelling better in speaking skills.

In high school context, Yuliani and Lengkanawati (2017) examined whether PBL promotes LA of six high school students in an EFL Classroom. The qualitative data was collected through document analysis, observation and interview. The results revealed that PBL has promoted LA including “self-instruction, self-direction, self-access learning and individualized instruction” in the planning, implementation and monitoring process of PBL. In addition, the learners were found to gain the highest degree of LA in the Implementation Process. The findings also illustrated that there is a linear relationship between learners’ achievement and LA.

Regarding the studies in tertiary education, Mesa Villa and Armstrong (2004) investigated teacher and EFL undergraduate learners’ experience of PBL in Colombia. The results of the interviews indicated that PBL promotes learner autonomy as they discover how to learn, apply what they have learned in this experience to lifelong learning, pick what they want to learn, create their own goals and plan activities to achieve them, and lastly assess the process and outcomes of the experience in order to learn from it. Moreover, it is found out that PBL helps students to facilitate the skills required to work collaboratively as they engage in dialogue, develop their own criteria, and they make decisions in an integrated way.

In the same vein, Smith (2005) examines the autonomy and factors mediating the employment of autonomy in the collaborative PBL classrooms at The University of Melbourne. After two-year implementation, the autonomy expected of students was found to be “reactive rather than proactive” (Littlewood, 1999), the strongly mediating

autonomy factors included teacher and institution rules institution, the division labour, student's own confidence and proficiency with L2.

Furthermore, McCarthy (2010) conducted a teacher-initiated classroom action research to examine whether PBL could foster autonomous learning of 192 non-English majoring Japanese students in an EFL classroom. Data was collected by means of pre- and post- PBL questionnaires, semi-structured interviews and observations to find out changes in students' perception of autonomy, their self-efficacy, and teacher's role indicated success in autonomy. However, it is found out that learners showed minimal effort and were tend to study for getting higher credits rather than for the development of L2.

In another teacher-initiated research, Sarwar (2010) also sought the materials, strategies and approaches utilized to teach English in under-sourced EFL environment having outdated syllabi and untrained teachers. In that sense, the study investigated the ways in which PBL facilitated learner autonomy for college students in an EFL learning context. To focus on the outcomes of PBL in large EFL classes, participants included a total of 225 students and 5 teacher researchers enrolled at two public and one private colleges in a major city of Pakistan. Researchers were asked to fill in pre- and post-PBL questionnaires and interviews were conducted with them upon the completion of the project. Also, students were required to fill in pre- and post PBL questionnaires. Moreover, telephone and group interviews as well as open-ended reflections were employed with randomly selected students to find out their perceptions on PBL process. The results gathered from 5 EFL classes indicated that for learners, teachers still played significant role as a facilitator. Moreover, some students reported anxiety while gathering materials for their projects and only a few of them pointed out lack of them while conducting projects. Also, outcomes from PBL included positive learner views on learning through PBL, confidence building strategies, increased improvement in language skills and teachers' gaining awareness of learner autonomy as a potential learning.

Furthermore, Hafner and Miller (2011) sought the effects of a collaborative digital video project in a technological learning environment for fostering learner autonomy in an English-medium university in Hong Kong. During the

implementation, students were asked to create student-centered digital video project and share a multimodal scientific documentary. In line with this, new technologies and YouTube and Edublogs as Web 2.0 platforms were added to the project for a technologically rich learning environment. Data collected through students' accounts including questionnaires, interviews, and Weblog comments resulted that project facilitated learner autonomy developed motivation, independent learning, team work and the learning process within a structured language learning context.

On the other hand, Stefanou, Stolk, Prince, Chen and Lord (2013) examined student self-regulated learning strategies in problem-based learning and PBL environments. In addition, 77 undergraduate US students' self-regulation was investigated. Quantitative results suggested no statistical differences regarding motivations and behaviours but higher cognitions such as elaboration, critical thinking and metacognition.

In a case study, Güven (2014) examined the opinions of 50 Turkish EFL students about the PBL implementation to foster their autonomy. The data were collected through face to face interviews and open ended questions. Results indicated that PBL could be used as an impactful method to guide learners improve towards autonomous learning.

Within a quantitative study, Akhand (2015) investigated PBL and web-quest to foster learner autonomy in a territory level class. The participants were 20 students in the Masters programme whose L1 is Bangla and L2 is English. The writing assignments of the students were self-assessed by means of a rubric integrating students' both language use, use of web-quest and technology based on the readings. The results revealed that students' autonomy in the classroom, learning, and performance boost in an integrated way by means of using PBL and web-quest.

Loi (2017) investigated the impact of project work in EFL on the learner autonomy of 50 students. The data was collected by means of a questionnaire and interviews. The results revealed a higher learner autonomy and self-decision upon participating in project work.

Accordingly, Sukerti and Yuliantini (2018) examined 25 undergraduate students' attitude on learning autonomy through the implementation of PBL in ESP writing class. Data was collected by means of classroom observations, cause and effect essays, project presentations with the aim of describing the implementation of PBL whilst an interview and a questionnaire were conducted to find out students' attitude towards learning autonomy in completing writing task using PBL approach. The results revealed that PBL in writing class is advantageous for encouraging students collaboratively outline while producing drafts and essays. In addition, it is indicated that students were able to involve in a deeper and more autonomous learning as they supported each other during group discussion and make a progress for grammar practice while writing and revising their drafts.

Lastly, Rostom (2019) conducted an experimental study to explore the impact of PBL on the autonomous learning of 30 ESP Moroccan university students. In that sense, students are asked to engage in a paired project assignment that needs to be presented and discussed in class. Results gained through analyzing and reflecting on students' projects revealed that PB instruction increases students' autonomy and self-commitment, facilitates their understanding of the topic presented and enhances their motivation for language learning and speaking skills. The results also indicated that students like using technology and multimedia aids while preparing for and delivering their final presentations.

In conclusion, the revived literature indicated that PBL was suggested as a key methodology to develop learner autonomy levels of students in secondary, high school, and tertiary education providing them appropriate and meaningful context to be responsible of their own learning in EFL context. In parallel with its positive outcomes for L2 productive skills and learner autonomy in the previously mentioned studies, the following section presents the PBL and its effects on the development of 21st century skills.

2.6 21st century Skills and Key Frameworks

PBL has been identified as a key methodology for developing 21st century knowledge and skills (Andreas, 2006). As aforementioned, globalization and technological developments are transforming the globe into a more varied and linked place. Individuals must overcome evolving technology and interpret vast volumes of accessible information in order to function well and perform properly in modern environment. In that sense, meeting one's goals in the twenty-first century necessitates a fundamentally diverse set of skills and competences. In this ever-changing world, students' skills have become critical for high-quality education. As a result, during the beginning of the twenty-first century, a number of attempts were made to define and specify the competences and abilities necessary for functioning in the new millennium, as well as tackling current and future issues. These have been frequently referred to as 21st century Skills, and they are thought to be important for prospering in a quickly changing economy and environment.

However, according to the literature review, there is no distinct definition of 21st Century Skills is adopted worldwide. Therefore, several skills are assigned as 21st Century Skills (Joynes, Rossignoli & Amonoo-Kuofi, 2019, p.8). However, there is a consensus on the requirement of these skills to deal with global challenges and the necessity of integrating them into education (AACTE & P21, 2010; P21, 2007).

According to Voogt and Roblin (2010), the term '21st Century Skills' or '21st century competences' is "an overarching concept for the knowledge, skills and dispositions that citizens need to be able to contribute to the knowledge society" (p.16). In the same vein, Scott (2015) defines 21st century skills as "the knowledge, skills and attitudes necessary to be competitive in the twenty-first century workforce, participate appropriately in an increasingly diverse society, use new technologies and cope with rapidly changing workplace" (p.8). With a more recent definition, Chalkiadaki (2018) defines 21st century Skills as:

Encompassing a broad range of skill sets and professional attributes, including: creativity, divergent thinking, critical thinking, team working (especially in heterogeneous groups), work autonomy, developed cognitive and interpersonal skills, social and civic competences, responsible national and global

citizenship, consciousness of interdependence, acceptance and understanding of diversity, recognition and development of personal attributes, interactive use of tools, communication in mother tongue and foreign languages, mathematical and science competence, digital competence, sense of initiative and entrepreneurship, accountability, leadership, cultural awareness and expression, physical well-being (p.5).

Over the past two decades, there has been a great deal of interest in incorporating 21st century skills into teaching programs. Even though the term is considered contemporary, these skills are “not new, just newly important” (Silva, 2009, p. 631). The interest has been generated due to the challenges that students face in the changing world and the need for educational programs to prepare students for these challenges. Education programs at all levels need to focus not only on 21st century competencies but also academic learning goals focusing on content. With this realization in mind, teachers, education experts, business leaders, and many organizations got together to design and develop different frameworks which outline the competencies and the skills 21st century students require to be successful at school, at work and in other parts of life for thriving in a rapidly changing economy and world (Framework for 21st Century Learning, 2007). A number of international organizations have proposed current conceptual key frameworks for 21st century skills, namely Assessment and Teaching of Twenty-first Century Skills (ATCS), the Partnership for 21st Century Skills (2006), the Metiri Group and NCREL (2003), the American Association of Colleges and Universities (2007), and the Organization for Economic Cooperation and Development (OECD) (2005).

When these frameworks for 21st Century Skills are studied closely, it becomes clear that they reflect overlapping skills that are categorised in a variety of ways. Each of the ways to comprehend 21st century skills stresses skills that deviate from current academic fields’ typical conceptions and shared set of 21st century competencies including ICT literacy, creativity, critical thinking, collaboration, communication, productivity, and problem-solving (Voogt & Roblin, 2012). However, The Partnership for 21st Century Skills Framework (2006), specifically learning and innovation skills,

namely 4Cs, serves as a baseline and main reference for this thesis as “P21’s conceptualization of 21st Century skills is more detailed and more widely adopted than any of the alternatives” (Dede, 2009, p. 4).

The P21 Framework for 21st Century Learning has become well-known particularly in the field of education (P21, 2009). This Framework combines topic knowledge, particular skills, expertise, and literacies to explain the skills and knowledge students must master in business and academic life. Each 21st century skills necessitates the development of fundamental academic subject knowledge such as “English, Reading, Language Arts, World Languages, Arts, Mathematics, Economics, Science, Geography, History, and Government and Civics as well as interdisciplinary themes global awareness, financial, economic, business, civil literacy, health literacy, and environmental literacy” (Albahlal, 2019, p. 144). In addition, students must also learn the essential skills for success in today’s world, such as critical thinking, creativity, communication and collaboration, also known as 4Cs. The framework consists of eleven competencies classified into “three gist elements including learning and innovation skills, information, media, and technology skills, and life and career skills”. Life and Career skills consist of “flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility” (Okros, 2020, p.155), whilst Information, Media, and Technology skills comprise of “information literacy, media literacy, and ICT literacy to access and use information, to create and analyze media products, and to apply technology effectively” (Trilling & Fadel, 2009, p. 67). A support system that includes standards, assessments, curriculum, instructions, professional development, and learning settings is also included in the framework as indicated in figure 4.



Figure 4. Partnership 21 curriculum framework

The core skill capabilities and knowledge demands of the past are being replaced by new criteria for students. To meet this challenge, schools must be changed in such a manner that students may acquire the creative thinking, flexible problem-solving, and teamwork skills, which they need to excel in business and in life (Pacific Policy Research Center, 2010). Grounded on this, the question of how our students can create such experiences become prominent and the importance of 4Cs in education come to the forefront as indicated in Table 1.

Table 1

Pedagogical Meanings and Interpretations of the 4Cs

4C Skills	Pedagogical Meanings
Critical Thinking	According to Facione (1998), six core critical thinking skills include “interpretation, analysis, evaluation, inference, explanation, and self-regulation” (p. 73). “Critical thinking and reflection allow us to detect misconceptions and underlying problems as well as see new opportunities in practice” (Noonan, 2013, p. 177).
Creativity	Piirto (2011) mentions that creativity refers to making innovations ultimately. According to Moseley et al. (2005), “creative thinking can be imagining situations and events, generating new characters or scenarios, producing tentative explanations or solutions, and planning actions” (p. 313). “The dimensions of creativity include problem sensitivity, fluency of ideas, flexibility of thoughts, originality, imagination” (Torrance, 1966).

Collaboration Students' conversation, output, and reflection are all referred to as collaboration (Kaufman, 2013). According to Johnson and Johnson (2013), "collaborators create effective groups by (a) establishing goals, (b) sharing ideas and workload, (c) serving as facilitators and contributors, (d) sharing power and decision making, and (e) engaging in productive conflict" (pp. 24-26).

Communication

According to Piascik (2015), communication involves "sharing thoughts, questions, ideas and solutions" (p. 1). According to P21 (2015) communicating clearly is defined as having ability "to articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts; listen effectively to decipher meaning, including knowledge, values, attitudes and intentions; use communication" (p. 4).

From early childhood to higher education levels, the improvement of these 21st century skills is pursued globally (Benner & Hatch, 2010; Germaine et al., 2016; Lindeman & Anderson, 2015). In this regard, determining the appropriate language teaching pedagogies and technology integration tools to promote 21st skills of learners plays a crucial role in EFL context.

2.6.1 Integrating 21st century skills into language education. With the impact of globalization, rapid spread of technologic developments, and advanced emerging technologies, the world has become more intertwined and the desire to communicate and collaborate with people of various languages and cultural backgrounds has increased. As a result, the importance of learning English has evolved as a most commonly learned second language globally (Crystal, 2012). To strive in such a world, students are currently required to possess the 21st century skills, specifically 4Cs as well as the basic skills. Therefore, educational institutions, schools and EFL classrooms concentrate on providing students opportunities to acquire and develop these skills. However, as Pardede (2020) claimed "the integration of the 4Cs into

language skills learning should not be seen as additional content that brings extra burdens to both teachers and students. Instead, they facilitate and reinforce students' language skills mastery" (78). In this regard, there has been some descriptive studies which investigate teachers' views on 21st century learning and teaching (Bedir, 2017; Ceylan, 2019; Çolak, 2018; Gürültü, Aslan & Alcı, 2019; Ravitz, 2014; Tsourapa, 2018), students' perceptions on 21st century skills (Diker, 2019; Dulun, 2018; Garrison, 2018; Güler, 2019; Karakaş, 2015; Soh et al., 2010; Sümen & Çalışıcı, 2017), analysis of coursebooks in terms of 21st century use (Akçay, 2019; Bouzid, 2016; Yeni, 2018). However, there have been a limited number studies that investigate the implementation and assessment of 21st century skills in EFL classroom (Halvorsen, 2018; Kaufman, 2013; Kutlu-Demir, 2018; Ruminar & Gayatri, 2018; Wongdaeng & Hajihama, 2018).

2.6.2 Research on PBL and 21st century skills. PBL has a vital role to foster 21st century knowledge and skills (Harun, 2006). According to Bell (2010), "From gleaming new, viable technology skills, to becoming proficient communicators and advanced problem solvers, students benefit from this approach to instruction" (p.1). PBL has been found out to increase creativity and innovation in EFL contexts in different educational backgrounds, levels and age group of learners (Clark, 2009; Ford & Kluge, 2015; Lubis et al., 2018; Mohammed, 2017; Putri, 2018; Setiawan & Bharati, 2018; Takeda, 2016). In the language classes, PBL was evidenced to promote students' communication skills (Bakar et al., 2019; Chang, 2014; Farouck, 2016; Kovalyova et al., 2016; Lubis et al., 2018; Maulany, 2010), and provides students opportunities to deal with an authentic global concern and develop collaboration skills in pairs or groups (Levin-Goldberg, 2012).

To begin with, regarding the Indonesian EFL context, Rochmahwati (2015) conducted a qualitative research aimed to foster 25 students' 21st century skills through PBL. The PBL procedure was based on discussion of the materials about ELT, group work, scenario practice, video recording of teaching practice, and video evaluation. The data collected through observation and interview revealed that the implementation PBL resulted in an increase in the students' critical thinking and positive attitude toward the implementation of PBL. The research highly recommended the

implementation of PBL in EFL classes as a way of facilitating and building the students' their critical thinking as well as other 21st century skills.

Gilroy (2016), as a teacher researcher conducted an exploratory and informal action research conducted to understand the different skills students practice through their Integrated Skills Projects (ISPs). ISPs are kinds of projects where language skills such as reading, writing, listening, speaking and vocabulary are combined with 21st century skills such as collaboration, communication, critical thinking and problem solving. The data was collected by a teacher-researcher whose class was engaged in the ISPs. Accordingly, the teacher kept a journal during ISP period to make notes on different kinds of activities students were working on. The analysis of the notes revealed that in addition to developing presentation skills, the ISPs were also effective in developing many other 21st century skills. Among these skills, critical thinking skills were reported to occur with higher frequency during ISP practices. Besides, some sub-skills such as brainstorming, problem solving, questioning, evaluating, analyzing and reflecting are also reported to develop through taking part in project-based learning.

In another study, Giri (2016) aimed to reveal perceptions and practices of PBL in Nepalese EFL context. Interviews and observations revealed that PBL is warmly welcomed and accepted as an integral part of academic activities, fostering co-operation and collaboration among the students. For instance, regarding the social problems in the local area, students were found out to be engaging in their local community, interviewing various people, taking video clips and photographs along with their classroom discussion and Internet surfing to find solutions to the problems within a collaborative approach.

In a parallel study, Wongdaeng and Hajihama (2018) examined the 30 Thai EFL student perceptions of PBL on promoting 21st Century Skills namely, collaboration, communication and learning motivation. Data was obtained from the survey. Results revealed that PBL is perceived to be effective in enhancing the learner's motivation to learn English and developing the target 21st century skills as well.

Different from the previous studies, Devkota, Giri and Bagale (2017) focused on

revealing the teachers' perceptions and practices of PBL in Nepalese EFL context. The data collected through semi-structured interviews revealed their experience and the issues they had raised in the course of interview. Accordingly, the major questions were mainly focused on challenges and opportunities of using PBL in Nepalese context in order to develop 21st century skills in the learners. In that sense, the findings revealed that PBL was a new concept in educational practices, which was considered to provide opportunities for the learners to work collaboratively. Besides, it was considered to be interdisciplinary in nature to develop various 21st century skills. However, the current pattern of curriculum and classroom were considered insufficient, which referred to the need for change for creating the learning environment for the 21st century learners. Also, the lack of necessary equipment for developing 21 century skills was emphasized. Apart from these, teacher roles were questioned, and teachers were suggested to adopt roles such as facilitator, coordinator, initiator and guide working with the students.

In a similar vein, Allison (2018) conducted an action research study to investigate how instructional staff members at a rural high school can improve their PBL instructional practices so that students can acquire 4Cs. Through Appreciative Inquiry, instructional staff members were expected to identify what components of PBL influenced students to acquire 21st century skills, and to have a shared vision for the implementation of PBL. The participants were six instructional staff members who worked as a part of the action research team, 44 instructional staff members and the researcher himself. The data were collected through appreciative interviews, possibility statements, action plans and strategies and an open ended survey assessing teacher perceptions of the PBL. In order for data analysis, pattern coding was applied. Accordingly, the results revealed that the top three strengths of PBL were enabling students to learn from mistakes and to take responsibility for their learning, and that projects come in all shapes and sizes for all students. As opposed to common understanding, the research did not reveal a tight fit between PBL and the 4Cs. But still, instructional staff members considered PBL as a way to promote 4Cs. Besides, it was indicated that instructional staff members are willing for professional development on grading PBL lessons, as well as integrating PBL into the curriculum.

Regarding different subject areas, Wan Husin et al. (2016) aimed to find out the effects of an integrated Science, Technology, Engineering and Mathematics (STEM) education based on Project Oriented Problem Based Learning (POPBL). Accordingly, the program integrated PBL into STEM education with multi-disciplinary activities based on student-centered approach to develop 21st century, higher-order thinking and research skills of 125 secondary students. The results of the study questionnaire revealed that an integrated STEM education program based on POPBL resulted in higher levels of 21st century skills among the students.

In a pre-experimental research, Bani-Hamad and Abdullah (2019) explored the effect of PBL on improving 4Cs among 20 secondary level students. For the research procedure, the researcher proposed various authentic problems, and grouped students were expected to select a real life problem and to find a solution via projects. Accordingly, their 4Cs were tested through a test prepared by the researcher. The findings revealed that there were statistically significant differences between students' pre and post test results in terms of their levels of 4Cs. Also, the findings indicated that students are less capable in creative and critical thinking compared to their skills in communication and collaboration skills.

With a more recent study, Warr and West (2020) aimed to describe the implementation of an interdisciplinary design studio as a way of teaching creative problem-solving through PBL. In studio-based pedagogy, students are considered to learn by working on authentic problems with their peers and mentors in the context of a studio. In the study, the implementation of studio pedagogy differed across courses such as Business, Social Sciences, Arts and Communication, Humanities, and Mathematics Science. However, all courses followed the same procedure, which was interdisciplinary, thickly authentic, PBL. Within the study following a post-positivist qualitative approach, the data were obtained from 196 students through interviews, observations and surveys revealed a summary of student experiences across a range of courses conducted in the interdisciplinary design studio. Accordingly, students considered studio courses flexible so that they designed their own learning experience independently. Besides, the students indicated that such an interdisciplinary, thickly authentic, PBL type of instruction enabled students to develop interdisciplinary

problem-solving skills enabling them to better address complex, wicked problems. Additionally, that interdisciplinary aspect of the design studio is considered to deepen students' interdisciplinary collaboration, creativity, and communication skills as well.

Up to this point, the previous studies in the literature review which focus on the PBL to develop 21st century skills of students are outlined. As elaborated in the previously mentioned studies above, PBL implementation process could be supported with various themes. In line with this, when project topics are of group interest and of the authentic problems which students think need solutions, they become engaged in communicative activities for working in groups to discuss, carry out a task, do oral presentations and specifically work together on real life projects more enthusiastically and actively. In this regard, SDGs, as the content of the projects, are presented in the following section.

2.7 Education and SDGs

Within the scope of the projects created by the students, SDGs are in the center with their real life and global characteristics. Sustainable development aims at “building an inclusive, sustainable and resilient future for people and planet” (UN, 2015, p. 3). In relation to this, SDGs have been defined as “the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice” (UN, n.d.). “The goals are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity” (United Nations Development Program Online, 2018). These universal goals are indicated to “start on January 1, 2016, and to be achieved by December 31, 2030”. According to UN (2015) “The 17 SDGs with 169 targets aim to trigger action over the next 15 years by taking chief elements into consideration such as people, planet, prosperity, peace and partnership” (p. 2).

When education and the SDGs are taken into consideration, UNESCO emphasized the need for “Transforming learning and training environment via integrating sustainability principles into education and training settings” (2014, pp. 14-15). UNESCO indicated that “Education for Sustainable Development (ESD) empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity” (2014, p. 12).

UNESCO underlines that “No one discipline can claim education for sustainable development for its own, but all disciplines can contribute” (2005, p. 31). As a result, the SDGs can only be achieved through an interdisciplinary approach that emphasizes the interconnectivity of disciplines. In this context, as various researchers have emphasized, reaching such a goal clearly needs the adoption of multidisciplinary education (Dale & Newman, 2005; Eagan et al., 2002; Jain et al., 2013; Luppi, 2011). In this context, this study aims to make a contribution via specifically integrating the SDGs within ICT-Assisted PBL in EFL classroom.

There have been limited number of studies focused on raising awareness of students on SD and SDGs. In relation to the aim of this study, the ones which used specifically PBL to develop students’ knowledge and awareness of SD and SDGs (Cottafava, Cavaglià & Corazza, 2019; Jollands & Parthasarathy, 2013; Jumrodah, Liliyasi & Adisendjaja, 2019; Lehmann, Du & Thrane, 2008; Luo & Wu, 2015; Manolis & Manoli, 2020; Ramirez-Mendoza et al., 2020; Teff-Seker, Portman & Kaplan-Mintz, 2019) and used a mobile application (Çimşir & Uzunboylu, 2019) are introduced. On the other hand, there has been only one study (Akyüz, 2019) that integrated SDGs into ELT context to develop global citizenship levels of pre-service teachers. However, to my best knowledge, there haven’t been any studies in EFL context that incorporated SDGs into ICT-Assisted PBL to promote 21st century skills and L2 productive skills of students.

To begin with, there have been some studies specifically in engineering education that made use of PBL to foster SD and SDGs. Lehmann, Du and Thrane (2008) for instance, investigated the impacts and benefits of a problem-oriented

project-based learning paradigm for engineering education graduate students, faculty and communities at Aalborg University in Denmark. The results indicated that engineers' education must allow for interaction, mix, and variety, which POPBL entails, in order for them to be able to deal with sustainability-related issues. In another study, Jollands and Parthasarathy (2013) examined whether PBL enhances the understanding of sustainability of students enrolled at Chemical Engineering. The results indicated that the students' understanding of sustainability increased within PBL process. In a parallel study, Luo and Wu (2015) adopted an integrated approach and designed a joint course project focusing on sustainable design and building information modelling implementation. In this way, students worked in groups on artifacts and other activities to achieve predetermined sustainable goals for a real-world construction project, since PBL provides an appropriate framework for evaluating crucial elements that drive BIM execution in green building project delivery. According to the results of formative and summative assessments, PBL was found out to be very effective in cultivating student competencies in critical thinking and problem solving within a multidisciplinary project. Furthermore, Cottafava, Cavaglià and Corazza (2019) conducted a case study to explore an example of education for SDGs carried out at the University of Torino, with the aim of integrating SD with the active engagement of students. The findings demonstrated that students' empowerment was attained through a transformational learning experience centered on the development of management soft skills that could be used in co-creating and co-designing initiatives to successfully contribute to the SDGs. In that sense, students had a chance to learn about SDGs. With a more recent study, Ramirez-Mendoza et al. (2020) investigated the incorporation of SDGs in the curricular plans of engineering programs and presented some examples of academic projects dealing with different fields of Engineering. For instance, "No poverty, Quality education" was asserted as SDG research areas for Computer Science graduate program at the School of Engineering and Sciences in Tecnológico de Monterrey.

In line with these, Jumrodah, Liliarsari and Adisendjaja (2019) also investigated the 19 pre-service Biology teachers' critical thinking skills, based on learning project to build their SD competencies. The results of quantitative data confirmed that PBL toward SD improved critical thinking skills of the students. Furthermore, Teff-Seker,

Portman, and Kaplan-Mintz (2019) conducted a case study of planning students' experiences with Project- and Problem-Based Learning (PPBL) and investigated the impacts of PBL in education for SD. The results indicated that students in the PPBL group reported a statistically significant change in environmental behavior, whereas students in the control group reported no significant changes in conduct or attitudes. In addition, students in the PPBL group recalled more information and planning compared to the control group peers. Moreover, Manolis and Manoli (2020) examined how to raise awareness of the SDGs through ecological projects in higher education. Results of questionnaire revealed that ten ecological group projects' completion and presentation affected students' cognitive, social and moral level and raised awareness of the SDGs.

Different from the previously mentioned studies, Çimşir and Uzunboylu (2019) conducted an experimental study to develop, implement and evaluate a mobile application for the awareness of 62 volunteer university students about SDGs in Turkey. Data collected by means of the Sustainable Development Awareness Questionnaire revealed that the developed mobile application had a positive impact on university students' awareness of SDGs, and they were pleased to use it. Lastly, regarding the EFL context, Akyüz (2019) conducted a longitudinal case study to examine the impacts of the integration of Global Citizenship Education (GCE) into English Teacher Education in relation to the SDGs in Turkey. The study's findings suggested that incorporating the GCE program into English Teacher Education Pedagogy via the SDGs improved the preservice teachers' GC levels.

In conclusion, as indicated in the literature review above, ICT-Assisted PBL is a student-driven method implemented with multi-purposes in various EFL settings. In this study, through ICT-Assisted PBL, 21st century skills, L2 productive skills, learner autonomy, and SDGs awareness of EFL students are aimed to promoted.

In order to reach these goals, specifically, the following research questions were addressed in this study:

1. Is there a statistically significant difference in students' level of 4C skills

(critical thinking, collaboration, creativity, communication) after being exposed to the ICT-Assisted PBL?

2. Is there a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their productive skills in L2?
3. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their perceived levels of L2 speaking and writing self-efficacies?
4. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their self-perceived autonomy levels?
5. Is there a statistically significant difference in the perceptions of students regarding
 - a. PBL qualifications
 - b. 4C skillsafter being exposed to the ICT-Assisted PBL?
6. What are the students' opinions about the ICT-Assisted PB instruction?
7. What are the opinions of the lecturer about the implementation of the ICT-Assisted PBL?

Chapter 3

Methodology

3.1 Introduction

In this chapter, before the presentation of the actual study; the pilot study, contribution and the results of the piloting are introduced. Following, the research design, setting, participants, the major data collection tools including questionnaires, semi-structured interviews, students' written reflections and teacher's field notes are outlined. In addition, the data collection and analysis principles and procedures adopted for the qualitative and quantitative data as well as the ethical considerations are detailed. Lastly, the limitations of the study are presented.

3.2 Pilot Study

Prior to the actual experimentation, to confirm reliability before beginning to gather the essential data for the current investigation, the pilot study was conducted with 220 EFL students enrolled at different departments of Engineering Faculty at Kırklareli University within the face-to-face courses during the spring semester of 2019-2020 academic year and lasted for five weeks. The purpose of the pilot study was to assess the questionnaires' applicability, identify and address any unexpected issues, as well as to assess the amount of time allotted for answering questions and following procedures during the real data collecting phase. The participants of the pilot shared similar characteristics (age range, B1 level, sophomores, EFL context) with the ones in the actual study. During this process, all ethical issues were taken into consideration, and all participants were guaranteed that their responses would be kept anonymous via a verbal protocol and written consent forms.

During the piloting, the participants were presented with the four types questionnaires aiming to identify their self-efficacy levels of L2 productive skills, perceptions of 4Cs, PBL self-efficacies and learner autonomy levels (which were outlined below). For the administration of the piloting, the time allocated to answer the items was set to 30 minutes, and it was successfully accomplished. In line with

these, the implementation period of the piloting lasted for five weeks including 20 lessons in total. To this end, some technical and timing problems for future experimentation were eliminated as a result of the pilot study. Additionally, it provided the researcher invaluable insight into the required procedures and effective ways to conduct data collection that were most convenient for the participants.

3.2.1 Implementation process of the pilot study. Initially, the researcher applied for the permission from the institution for the piloting of the questionnaires and implementation of the study. After taking the required official approvals, the questionnaires were administered as pre-tests. Following this, the first week began with the introduction of the PBL process and the SDGs were introduced to the students. For the piloting, the researcher made use of the framework created by Rosa (2018) which could be more accessible and selective for ELT within a pedagogic sense. Regarding this PBL framework, the T followed each step one by one so as to develop students' L2 productive skills and 21st century skills at the same time. The implementation period of the piloting study was planned to last for 12 weeks with face to face courses. However, because of COVID-19 break, the piloting lasted for only five weeks as all of the educational institutions from primary to tertiary level were closed in the whole country. Within this process, four different classes including 220 students in total enrolled at different faculties of Engineering participated in the study.

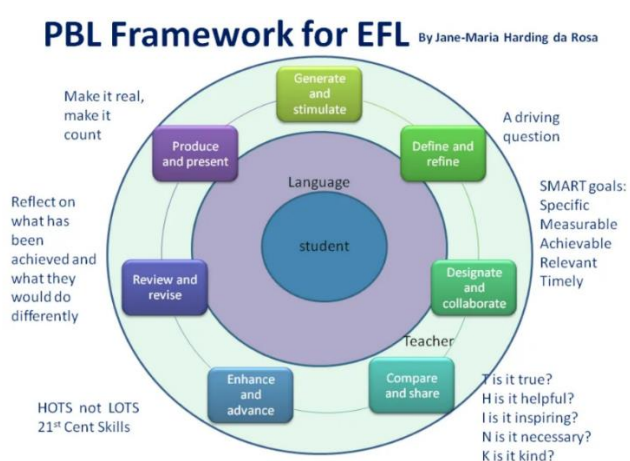


Figure 5. PBL framework for EFL (Rosa, 2018)

Week 1 (February 3-4, 2020). To begin with, the 21st century Skills

Questionnaire, Project-Based Learning Qualifications Scale, Self-Efficacy Scale for English, and Autonomous Learning Scale were administered to the students in order to measure their perceptions before starting the ICT-Assisted PBL implementation via making use of Google Forms Survey. All the participants were informed that there weren't any right or wrong answers and their scores wouldn't be graded and their names and scores would be strictly kept confidential and anonymous. The questionnaires were completed by all the participants within 30 minutes. Following the questionnaires, pre semi-structured interviews, each of which lasted for almost 30 minutes, were conducted with 15 voluntary students with in the school campus at their convenience. Following the first lesson, in order to familiarize students with ICT-Assisted PBL, T presented the content of the lessons regarding PBL steps, project topics, and PBL process for half an hour. According to the ICT-Assisted PBL schedule, learning outcomes consisting of the objectives, and 21st century skills as well as L2 productive skills that learners were expected to acquire and perform were highlighted. The students were asked to form groups of four or five and they were informed that they would be working as a group for both the in-class and out of class activities regarding the PBL process. Then, the students were given extra time to determine their groups and assigned groups were noted. In order to develop students' awareness and understanding of the SDGs, as the themes of their projects, the following activities adapted from the first chapter of the book "Integrating global issues in the creative English language classroom: With Reference to the United Nations Sustainable Development Goals" (Maley & Peachey, 2017) were utilized within three-hour face to face class.

Regarding the in-class activities, as a warm-up activity, ss brainstormed on the biggest problems in the world via discussing the project photos T had prepared. Then, ss accomplished the SDGs matching by means of the interactive quiz and in pairs they chose three goals as top priority for them and explain reasons behind their choice. As another in-class activity, the ss read an article on SDGs and explained the content of the articles in small groups. In terms of generate and stimulate, this week included deciding which problem they want to explore a group and finding out a challenging real world problem that they can connect, specifically on No poverty and Zero Hunger. Regarding define and refine, ss were expected to form a driving question. Each group

within a class had a different driving question that was specific to their interests. In that sense, they started with a big question, refined and simplified these questions. To this end, a driving question: “What is our role in solving no poverty and zero hunger problems in the world?” was chosen. For designate and collaborate phase, as suggested by Rosa (2018), the project was thoroughly designed by collaborative groups within timely principles and the tasks were specifically designated to the learners. Activities and useful links with supplementary teaching aids were uploaded to ALMS and EDMODO before each class so that each group could make use of them to acquire background knowledge and get ready for the following class with questions. At this point, the goals were visually displayed which had been set, who was doing what, and timescales were determined by the students. This was a chance to appreciate every member of the class.

Week 2 (February 10-11, 2020). The second week included student-directed activities such as working in groups during face to face lessons, ongoing group discussions for their project development, making a detailed action plan to achieve Goals 1 and 2, creating a spidergram showing reasons, solutions and giving justifications to SDGs 1 and 2, discussing the quote “Earth provides enough to satisfy every man’s need but not every man’s greed” by Mahatma Gandhi and creating a poster related with material, non-material, and basic universal human needs for well-being around the world. Within these lessons, ss reflected on the question of wealth and poverty, via answering various open-ended questions related with well-being. Lastly, out-of-class, ss were expected to investigate more on problems of food which were included in the worksheet and include this information in their future web-sites.

Week 3 (February 17-18, 2020). During this week, ss examined problems with food. In groups, ss discussed environmental or social problems caused by people eating some of the specific foods. Ss also matched the products, headings, and paragraphs by means of worksheet 1, 2, and 3. Ss were expected to discuss the issues of “child labour/slavery, food miles, overfishing, loss of biodiversity, fairtrade, land clearing, hormones, antibiotics, too much water in processing, too much packaging” after reading the paragraphs and elaborating on more about the reasons and possible solutions to these particular problems. In terms of compare and share, continuous

feedback was provided within each week. Regarding enhance and advance, learners made use of their potential skills and background knowledge to reconstruct new experiences. Ss engaged in collaborative text creation via making use of various webpages T suggested. In each phase, T aimed to provide ss necessary language input to fulfill the task and giving instant feedback both in class and out. Lastly, regarding action newspaper & protest banners, ss as a group, created a newspaper front page with eye-catching headlines relating to hunger, malnutrition, food commodity markets.

Week 4 (February 24-25, 2020). The fourth week comprised of activities such as debating on the pros and cons of having GM crops. As a class competition, project groups created and then selected “The most sustainable food diary /café menu /best plan to end hunger and malnutrition in the world”. In terms of making comparison, ss discussed and compared different diets around the world, the most nutritious and the most sustainable for the planet. Out-of-class, ss were expected to draft their compositions and web-sites to take feedback.

Week 5 (March 2-3, 2020). The fifth week was the presentation of their final projects, web-sites and delivering the problem solution-compositions on SDGs 1 and 2 (No poverty and Zero Hunger). In terms of review and revise, ss evaluated the whole project process, and comment on their work. The learners were provided with the language while carrying out the tasks, doing the research, presenting their findings. T gave opportunities to develop the L2 productive skills and 21st century skills while on the PBL path. In terms of produce and present, the web site they created was an example of solving poverty and hunger problems in the world, was the final product to be presented to whole class. In this regard, ss presented the real life problem solutions regarding the creation of their websites to the class as a group and shared their group projects in front of the class. Their presentations were recorded. Each group presented almost 20-25 minutes. The presentations took two weeks. After each presentation, group members and other teams reflected on the presentations and solutions via giving feedback. Ss uploaded the revised version of their presentations, web-sites’ links, and their problem solution compositions to the EDMODO and ALMS.

3.2.2 The results of the pilot study. Data was analyzed by means of SPSS Statistics version 20. The significance of the Cronbach's alphas obtained was compared to the value of alpha ($= 0.70$) to determine whether they were acceptable. (Kaplan & Saccuzzo, 2008; Mertler & Vanatta, 2005). According to, Gliem & Gliem (2003) "Cronbach's alpha reliability coefficient normally ranges between 0 and 1. The closer Cronbach's alpha coefficient is to 1.0 the greater the internal consistency of the items in the scale" (p.87). The Cronbach's alpha coefficients varied from $\alpha(.809)$ to $\alpha(.935)$ for the scales used in this study. The results indicated that all the items of the scales had Cronbach's alpha indicators that exceeded the test value of $\alpha(.70)$ and thus considered to be acceptable reliable scales.

Table 2 presents a summary of the results of the Cronbach alpha for each scale. Initially, cronbach's alpha value is $\alpha = .835$ for the 21st Century Skills Questionnaire (Yılmaz & Alkış, 2019), which indicates a high level of internal consistency for our scale with this specific sample. The reliability coefficients of each section of the scale have been found as $\alpha = .669$ for Creativity, $\alpha = .706$ for Critical Thinking, $\alpha = .772$ for Communication, and $\alpha = .595$ for Collaboration. For the Self-Efficacy Scale in English (Üstünlüoğlu, Bümen & Öğretmen, 2018), Cronbach's alpha for is $\alpha = .935$, which has the highest internal consistency among the four scales used in this research. The reliability coefficients of each section of the scale have been found as the following: Writing in L2 ($\alpha = .869$) and Speaking in L2 ($\alpha = .916$.) For the Project-Based Learning Qualifications Scale (Tuncer & Yılmaz, 2013), Cronbach's alpha is $\alpha = .927$, which shows the scale has a high internal consistency. The reliability coefficients of each section of the scale have been found as the following: Introduction to Project Qualifications ($\alpha = .731$); Group Work with Project Group Qualifications ($\alpha = .866$); Project Self-Control Qualifications ($\alpha = .607$); Conducting Project Qualifications ($\alpha = .846$); Project Finalization Qualifications ($\alpha = .797$). Lastly, for Autonomous Learning Scale (Arslan & Yurdakul, 2015), the Cronbach alpha value is $\alpha = .809$, which indicates a high level of internal consistency. The reliability coefficients of each section of the scale have been found as the following: Independence of Learning ($\alpha = .721$) and Study Habits ($\alpha = .731$). These reliability analyses for each scale indicated well-structured items. Thus, none of the items were eliminated.

Table 2

Summary of Reliability Statistics for Each Scale

Scale	Cronbach's Alpha	N of Items
21st century skills questionnaire	.835	18
Self-Efficacy Scale in English	.935	16
PBL Qualifications Scale	.927	22
Autonomous Learning Scale	.809	12

To conclude, for the quantitative part, the results of the reliability analysis through Cronbach's Alpha revealed that each questionnaire is detected as reliable (ranging from $\alpha = .809$ to $\alpha = .935$) and therefore eligible to utilize for the research. For this reason, there are not any minor or major changes regarding the methodology. In relation with this, informal talks with the students and their feedback on the lesson evaluation indicated that they found ICT-Assisted PBL as an effective methodology to develop their L2 productive skills and 4Cs. Specifically, students were observed to actively participate in the project development process to find out authentic solutions to real-world problems.

3.3 Research Design

This study follows a quasi-experimental design with pre- and post-tests and scales to be held at the beginning and the end of the study after implementation of ICT-Assisted PB instruction. Quasi-experimental design, without random assignment of participants to groups (Fraenkel & Wallen, 2003) was employed as the classes were arranged by the administration at the beginning of the academic year and random assignment of participants as well as clinical experimentation were not practical and possible for this specific study. In accordance with this, mixed method research design including the combination of both qualitative and quantitative data collection and

analysis procedures was used to enable a more comprehensive understanding of research concerns than either approach alone (Creswell & Plano Clark, 2011). As a result of converging and validating the findings from a set of scales, students' project products, reflection papers, field notes, and semi-structured interviews, the researcher is able to obtain broader information with an in-depth understanding of details, context, and nuances. This study encompasses the convergent parallel design, often referred to as the concurrent triangulation design (single-phase), since the data collection and data analysis processes were conducted at the same time but individually for qualitative and quantitative research questions. As shown in Figure 6, this strategy entails the collection of various but complementary data on the same phenomenon, which is then combined and interpreted using quantitative and qualitative data (Edmonds & Kennedy, 2017).

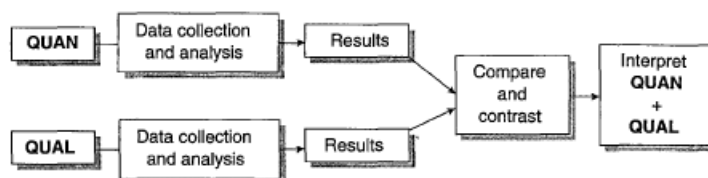


Figure 6. The convergent parallel design (Edmonds & Kennedy, 2017).

3.4 Setting and Participants

Convenience sampling was utilised to identify the participants and the research setting in this study. “A convenience sample is a group of individuals who (conveniently) are available for study” (Fraenkel, Wallen & Hyun, 2011, p. 91). In this regard, “the research participants are selected based on their ease of availability” (Given, 2008, p.124). The Engineering Faculty of a public university where the researcher works was chosen as the site for this research done during the 2020-2021 academic year in Kırklareli, Turkey, since it was conveniently accessible and allowed the researcher to carefully observe the research process. The participants included 120 Turkish EFL students, enrolled at Engineering Faculty of this state university. One experimental (24 females and 36 males) and one control group (27 females and 33 males), each with sixty students, having the General English III Course, varied in age from 19 to 24 years old. Their English language learning as a foreign language (EFL)

experience spanned from eight to fifteen years. The participants' English competence was B1 level (CEFR) at the time of the study, according to the institution's English proficiency exam. The students were in their second year in the university and passed General English 1 and 2 lessons successfully offered 4 hours a week. The aim of the students' to learn English includes meeting the job requirements in the sector, communicating effectively in the global market, and working for international companies. The researcher also the lecturer of the students had been teaching them for 2 years when this study was conducted. Grounded on this, researcher had background knowledge concerning the students' needs, interests, English proficiency levels, and their learning styles. All of the students signed an informed consent form (Appendix P) to participate in the current study for 14 weeks on a voluntary basis.

3.4.1 Information about the researcher. The researcher, who has worked as an EFL teacher for 13 years in various educational contexts from primary to tertiary level, was also one of the participants in the current study as the lecturer of the ICT-Assisted PBL program. She is currently employed as an EFL lecturer at a public institution, which also serves as the setting for this study. She has a BA and MA degrees in English Language Education. She has extensive experience teaching general and vocational English courses at various levels and in various contexts, which led her to investigate effective ways to respond to her students' needs and interests, eventually concluding that ICT-Assisted PBL would be a promising method for meeting their needs in terms of developing their L2 productive skills and 21st century skills in an integrated manner. For equipping herself with required knowledge and skills, she attended various seminars and online courses in relation to the integration of PBL into EFL class, development of 21st century skills, immersed herself in a wide variety of books on PBL, followed current academic articles on ICT integration into PBL, and applied what she learned from all these in her own classrooms. Her interest in promoting the 21st century skills and L2 productive skills through ICT-Assisted PBL and positive feedback upon the piloting process led her to focus on this type instruction as the basis of her doctoral thesis and examine the phenomenon in an in-depth, systematic way and share the results with wider contexts.

3.5 Procedures

To answer the research questions, both qualitative and quantitative data collection tools and data analysis procedures were utilized in this study. Table 3 presents the data collection instruments adopted to answer each research question, and data analysis procedures applied to analyze the data.

Table 3

Summary of the Data Collection Instruments and Data Analysis Methods

Research Questions	Data Collection Tools	Data Analysis Methods
1. Is there a statistically significant difference in students' level of 4C skills (critical thinking, collaboration, creativity, communication) after being exposed to the ICT-Assisted PBL?	Students' project products	Paired Samples T-test (SPSS) (within-group statistics)
2. Is there a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their productive skills in L2?	Students' problem solution essays and presentations	Independent Samples T-test (SPSS)
3. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their perceived levels of L2 speaking and writing self-efficacies?	Self-Efficacy Scale for English (Üstünlüoğlu, Bümen, & Öğretmen, 2018)	Independent Samples T-test (SPSS)

4. Is there a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their self-perceived autonomy levels?	Autonomous Learning Scale (Arslan & Yurdakul, 2015)	Independent Samples T-test (SPSS)
5. Is there a statistically significant difference in the perceptions of students regarding a) PBL qualifications b) 4C skills after being exposed to the ICT-Assisted PBL?	Pre and post perception scales a) Project Based Learning Qualifications Scale (Tuncer & Yılmaz, 2013), b) 21st Century Skills Questionnaire (Yılmaz & Alkış, 2019)	Paired Samples T-test (SPSS)
6. What are the students' opinions about the ICT-Assisted PB instruction?	Written reflections of 15 students during the implementation and Pre and post semi-structured interviews with 15 students	Content Analysis
7. What are the opinions of the lecturer about the implementation of the ICT-Assisted PBL?	Field notes kept by the researcher	Content Analysis

3.5.1 Data collection instruments. For the aims of this study, data were acquired using both quantitative and qualitative data collecting techniques, as this was a mixed method convergent parallel design. Quantitative data was collected by means of a variety of scales and students' scores based on project products, problem-solution compositions and presentations as listed in Table 3. Besides, qualitative data was collected by means of pre and post semi-structured interviews with the students, written reflections of students, and field notes taken by the researcher.

3.5.1.1 Students' projects. To find out students' development of 4C levels, they created 3 different projects including a web-site, mobile application, and an AR integrated brochure to solve real world problems including "No Poverty, Zero Hunger, Quality Education, Decent Work and Economic Growth" with reference to the UNs SDGs within PBL approach. In that sense, specifically students' first and third project products and presentations were evaluated by means of different rubrics.

3.5.1.2 Students' problem solution essays and presentations. To reveal whether there is a statistically significant difference between experimental and control groups in terms of their L2 writing performance, the students in both groups were asked to write three problem solution essays on the SDGs as the requirement of the course. The final versions of their first and third essays were evaluated by the researcher and a second rater using writing and speaking rubrics.

3.5.1.3 Self-efficacy scale for English. To assess the students' perceived levels of self-efficacies in English, specifically in terms of their productive skills, the Turkish adapted version of Self-Efficacy Scale for English (Üstünlüoğlu, Bümen & Öğretmen, 2018) was used. It is a 16-item scale, which is composed of two sub-sections: writing and speaking in L2. On a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), the participants were asked to provide their responses (Appendix B). The reliability coefficients of each section of the Turkish version of the scale was found as the following: writing in L2 (first ten 10 items of the scale, $\alpha=.873$) and speaking in L2 (last six 6 items of the scale, $\alpha=.896$) in the original study.

3.5.1.4 Autonomous learning scale (ALS). To measure students' learner autonomy, the adapted Turkish version of ALS developed by Arslan and Yurdakul (2015) was utilized (Appendix C). ALS was initially developed by Macaskill and Taylor in 2010. ALS is a 12-item scale with two subscales, Independence of Learning and Study Habits. Independence of learning includes seven items reflecting "the elements of responsibility for learning, openness to experience, intrinsic motivation, with an element of self-confidence in tackling new activities" whilst study habits consists of five items which "relates more to learning and study practices reflecting issues of time management, procrastination and attitude to lone working" (Macaskill & Taylor, 2010, p. 6). The scale is a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) and higher scores indicate "greater levels of autonomy, more independence and more positive attitudes to learning" (Macaskill & Taylor, 2010, p. 8). Cronbach Alpha coefficient reliability was reported as .80 by Arslan and Yurdakul (2015).

3.5.1.5 Project-based learning qualifications scale. In order to find out the students' PBL qualification perceptions, the Scale of Project Based Learning Qualifications including 22 items which are designed on the basis of a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) developed by Tuncer and Yılmaz (2013) was used (Appendix D). The scale consists of five subscales, i.e. introduction to project qualifications (items 1, 2, 3, 4); group work with project group qualifications (items 5, 6, 7, 8, 9, 10); project self-control qualifications (items 11, 12, 13); conducting project qualifications (items 14, 15, 16, 17, 18); project finalization qualifications (items 19, 20, 21, 22). Cronbach's Alpha coefficient for the overall scale was calculated as .864 by Tuncer and Yılmaz (2013).

3.5.1.6 21st century skills questionnaire. To find out the perceptions of students regarding the level of the ownership of 21st century skills, specifically 4Cs, 21st Century Skills Questionnaire developed by Yılmaz and Alkış (2019) was utilized. The instrument includes 18 items related to the classification of 4Cs and consists of 4 subscales, i.e. creativity (items 1, 2, 3, 4); critical thinking (items 5, 6, 7, 8, 9); communication (10, 11, 12, 13, 14, 15); and collaboration (items 16, 17, 18). The survey instrument is designed as a 5-point Likert-scale ranging from 1= "strongly

disagree that I have the skill” to 5= “strongly agree that I have the skill” for the Learning and Innovation Skills, 4Cs (Appendix E). The reliability coefficients of each section of the scale was found as $\alpha=.75$, $\alpha=.83$, $\alpha=.83$, and $\alpha=.61$. Cronbach’s Alpha coefficient for the overall scale was found as .884 by Yılmaz and Alkış (2019).

3.5.1.7 Written reflections. With the aim of understanding more about the situation under review (Merriam, 2009, p. 149) and in order to determine the major challenges, drawbacks, advantages students faced with and find out their opinions on developments of their productive skills and 4Cs during PBL process, the written reflections of the same 15 experimental group students who participated in the interviews were collected at the end of the first and third project sessions during the implementation process. In this regard, the students’ progress of 21st century skills and their ideas about this PBL approach were examined and elaborated by means of their pre and post written reflections obtained via their responses to nine pre-determined prompts (Appendix F). These prompts specifically sought for students’ perceptions on the emerging technology tools they used during project work, collaborative work, their awareness of SDGs and their integration into their projects.

3.5.1.8 Semi-structured interviews. In order to identify the students’ opinions on participating in an ICT-Assisted PBL class and determine their in-depth insights on the development of their 21st century skills as well as L2 productive skills during the implementation period, semi-structured interviews (Merriam, 2009) or semi-standardized interviews (Lune & Berg, 2017) were conducted with 15 volunteer randomly selected experimental group students at the beginning and the end of the study (Appendix G) individually. Interviewing is a “powerful way to gain insight into educational and other important social issues through understanding the experience of the individuals whose lives reflect those issues” (Seidman, 2013, p.8). During the interviews conducted in Turkish, students L1, the students were asked twelve open-ended questions aimed at eliciting details about the ICT-Assisted PBL implementation experience. In spite of having twelve predetermined open-ended questions related with the technology use and SDGs integration into projects, the process of PBL, collaboration during the project work at hand, the researcher was open to new insights and opinions emerged during the interviewing process. Semi-structured online

interviews took around 20 to 30 minutes via Zoom Videoconferencing and were audio- and video recorded, and participants orally renewed consent prior to the interviews. At the outset, the participants were reminded of the study's aim, the importance of their contribution to the research, and the anonymity of their replies. When necessary, the researcher made further explanations and reworded the questions for better understanding and clarification.

3.5.1.9 Field notes. To portray her opinions on the implementation of ICT-Assisted PBL to develop 21st century skills and L2 productive skills of the students, field notes were kept by the researcher (also the instructor of the program) throughout the whole procedure applied in each session over the course of 14 weeks. Grounded on this, field notes enabled researcher to enrich data and provide a better context for analysis (Creswell, 2013; Patton, 2002).

3.5.2 Data collection procedures. The procedures used to collect qualitative and quantitative data to answer the study questions were carried out independently since a convergent parallel mixed method design is employed in this study. After piloting and improving the data collection instruments for the study, all the required application forms and documents were submitted to the Research Ethics Committees (REC) of both of the universities where the research was conducted and the one the thesis took place three months before the start of the research process. Additionally, specific permissions were taken from the Engineering Faculty of Kırklareli University, in which the piloting and the research were taken place. Following the REC Approvals and the permissions taken from the Committees, whose aim is to ensure that all research procedures consisting of human participants are in keeping with the Ethical Guidelines adopted by the University Senate, the researcher briefly described the aim and procedures of the research to the participants, took their consent to participate in the study and started data collection process. Also, informed consent was taken from the inter-rater (Appendix P).

At the beginning of the study, Self-Efficacy Scale for English (Üstünlüoğlu, Bümen & Öğretmen, 2018), Autonomous Learning Scale (Arslan & Yurdakul, 2015), Project Based Learning Qualifications Scale (Tuncer & Yılmaz, 2013), and 21st

Century Skills Scale (Yılmaz & Alkış, 2019) were administered to experimental group. Additionally, pre semi-structured interviews were conducted with 15 students to explore their in-depth opinions on ICT-Assisted PBL, SDGs, ICT integration, and collaborative work on projects before the implementation began. At the end of the first and third project, the students' project products, presentations and problem-solution compositions were evaluated via rubrics. In line with this, at the end of the first and third project, students in the experimental group were instructed to submit written thoughts in response to prompts. During this process, the teacher kept field notes to follow the challenges, drawbacks, and developments during ICT-Assisted PBL process. After the treatment, the same scales were utilized as post-questionnaires and post semi-structured interviews were conducted with the same 15 experimental group students to explore their opinions on ICT-Assisted PBL process. On the other hand, the control group students which received traditional instruction were employed LAS, L2 Self-Efficacy Scale as pre and posttest. In a similar vein, their L2 productive skills were also evaluated by means of the the first and third problem-solution essays and power point presentations.

Procedure followed in the experimental and the control group is summarized in the table 4.

Table 4

Overall Main Study in Chronological Order for the Control and Experimental Groups

Dates	Control Group	Experimental Group
October 12, 2020	Pre-tests	Pre-tests
		Pre semi-structured interviews
		Introducing the PBL

November 9, 2020	Power point presentation 1 Problem solution composition 1	Presentation of the web-site Problem solution composition 1 Written Reflection 1
December 14, 2020	Power point presentation 2 Problem solution composition 2	Presentation of the mobile application Problem solution composition 2
January 11, 2021	Power point presentation 3 Problem solution composition 3	Presentation of the AR- integrated brochure Problem solution composition 3
January 18, 2021	Post-tests	Post-tests Post semi-structured interviews Written Reflection 2

3.5.3 Implementation. The implementation period lasted for 14 weeks with the experimental and control groups. So as to examine whether ICT-Assisted PBL made a statistically significant difference on students' L2 productive skills and 21st century skills, both groups of students were kept similar during the implementation period regarding the language input, the course materials, and the content of the course (SDGs), except from the instruction they received. Grounded on this, the only difference between two groups is the ICT-Assisted PBL followed within the experimental group. The online-synchronized lessons lasted for four hours every week were accomplished on Microsoft Teams and each meeting was recorded on stream. Breakout rooms were used for collaborative group activities specifically while being engaged in project work every week. Students were responsible of following the lesson requirements and had a chance to download all of the class materials from documents section of Microsoft Teams. Also, the lecturer made use of EDMODO platform at the same time. Students delivered their assignments via using Teams regularly and

constant feedback was given to students. Their project products, presentations and problem solution compositions were evaluated formally via using rubrics and formed 30% percent of their final scoring of their total grade. Therefore, 30 % percent of their assignments, 20 % percent of their mid-term, and 50 % of their final exams included their total score. Weekly Syllabus (Appendix A) includes the detailed presentation of the in-class and out of class activities followed in the experimental and control group during 14 weeks with reference to objectives, procedures, supplementary materials, and follow-ups. To this end, while activities implemented in the experimental group included the principles of PBL framework for EFL (Rosa, 2018), the control group exposed to traditional, teacher-driven methods of teaching. Each session concentrated on basic principles such as generating ideas on the problem they want to explore as a group, refining and defining the big ideas and driving questions, collaborating, comparing and sharing their ideas in each PBL process, presenting their final project products, and lastly reflecting on their own learning process. Students' choice and voice are taken into consideration specifically in PBL. For instance during the fourth week, with the aim of ending hunger and ensuring sustainable food systems and habits, the experimental group students were expected to develop their creativity in terms of originality and critical thinking of analysis for generating the most sustainable food diary, café menu, and best plan to end hunger and malnutrition in the world. Every group chose one of the topics according to their interests and either prepared a food diary, a menu, or the best plan to stop malnutrition with photos, drawings and videos. Lastly they made use of this activity in the web-sites they created. As a class competition, they reflected their ideas and found out the best one as a whole class challenge. On the other hand, control group students were worked individually in the assigned topics, made online investigation and presentation on their own. As indicated in this specific example, control group students were not expected to create their own products on collaborative groups. Instead, they researched and presented their ideas within a presentation.

3.5.3.1 ICT-Assisted PBL instruction in the experimental group. Regarding the treatment period, each week included four classes lasted for 60 minutes per each. Teacher, with the role of facilitator, guided the students in each project creation step regarding the group work, supplementary materials, use of ICT tools, etc. The students

were provided with necessary sources, feedback, and help instantly by means of online platforms. During the implementation phase, experimental group students worked collaboratively, within groups of four and five, on three different projects such as creating a website, a mobile application, and an AR integrated brochure over an extended period of time – a semester – that engaged them in solving a real-world problem or answering a complex question. The topics of the projects were selected from the UN's SDGs and from the main teaching aid "Integrating global issues in the creative English language classroom: With Reference to the United Nations Sustainable Development Goals" (Maley & Peachey, 2017) as indicated in Figure 7. The students were supposed to demonstrate their knowledge and skills by creating a public product or presentation for a real audience at the end of each project section. The implementation period included three sections each of which consisted of 4-week projects by means of using different emerging technologies and ICT tools within PBL. The students followed the PBL steps within the guidance of the teacher and they created an authentic product, which included the presentation of each project and problem-solution compositions at the end of each section. During this process, the students wrote reflections at the end of the first and third section. Also, the students' development in terms of 4Cs and L2 productive skills were monitored during this process. At the end of each section, their 21st century skills were assessed separately by means of rubrics via three different projects they created and their L2 writing and speaking skills were evaluated by means of the presentations and problem-solution compositions they produced.

Chapters	Authors
Developing an understanding of the Global Goals	Read, 2017
<i>No Poverty</i> : End poverty in all its forms everywhere	Zabor-Zakowska, 2017
<i>Zero Hunger</i> : End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Ruas, 2017
<i>Quality Education</i> : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Xerri, 2017
<i>Decent Work and Economic Growth</i> : Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Peachey, 2017

Figure 7. Chapters followed within ICT-Assisted PBL

Following these, initially the collaborative project groups were assigned. PBL, UN's SDGs, the scope of the activities, ICT tools, and weekly schedule were introduced to experimental group students. As the ICT-Assisted PBL was based on the UN SDGs, during the whole treatment, the researcher made use of the pack called "Integrating global issues in the creative English language classroom: With Reference to the United Nations Sustainable Development Goals" (Maley & Peachey, 2017) as a supplementary teaching aid and adapted version of the activities were used as shown in figure 8.

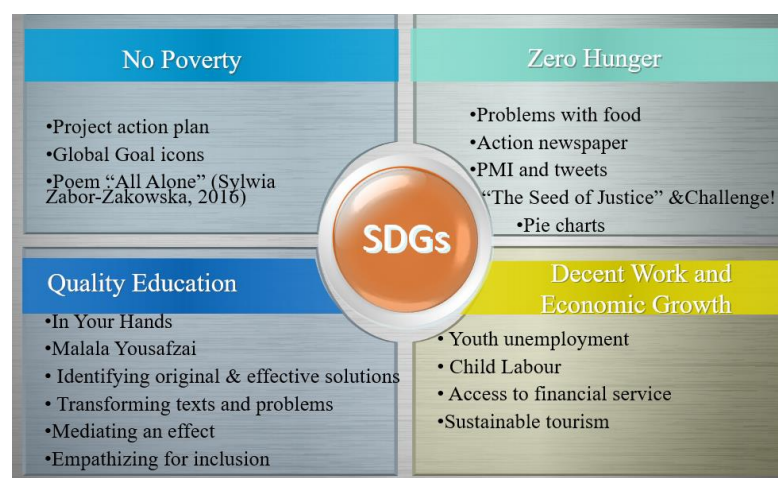


Figure 8. Summary of activities with reference to each SDG

In line with the aims of the ICT-Assisted PBL, the activities were adapted and organized in relation to the steps of ICT-Assisted PBL in a constructivist manner including identifying a real world problem to be solved, exploring challenge through collaborative activities, utilizing inquiry process, developing a final product to be publicized and ongoing reflecting during the whole process (Krajcik & Blumenfeld, 2006). The following titles were used by the instructor to convey the activities: objectives, language focus, SGD focus, 4C emphasis (creativity, collaboration, critical thinking, and communication), preparation, process, and follow-up (Appendix A). In addition, additional resources were utilized as extra activities. For the purpose of the study, the activities included in the weekly syllabus were written according to the dimensions of 4C skills' focus. For instance, five dimensions of creativity- problem sensitivity, fluency of ideas, flexibility of thoughts, originality and imagination- defined by Torrance (1966) were taken into consideration while determining the objectives of each ICT-Assisted PBL activity. In line with this, six core critical thinking skills- interpretation, analysis, evaluation, inference, explanation, self-regulation- according to Facione (1998, p.73) were used to classify the objectives regarding critical thinking skills of students. In line with these, the activities selected in the book were adapted for the objectives of the study, language learners' needs, interests, ages and language levels with differing timings. In that sense, the weekly schedule followed in the experimental group regarding the themes, products, and ICT tools were summarized in table 5.

Table 5

Summary of the Weekly Syllabus for the Experimental Group

WEEK	THEMES	PRODUCT	ICT TOOLS
WEEK	Pre-tests and Semi-structured Interviews		
1	Introducing the projects, ICT tools, SDGs, weekly schedule Arranging the groups, Selecting themes, Timeline and success criteria		

WEEK 2-5	SDGs No Poverty & Zero Hunger	Creating a Website	Wordpress, Wix, Weebly, Blogspot, Godaddy, Blogger, Medium, Google Sites
WEEK 6-9	SDG Quality Education	Mobile Application Development (Android or IOS)	Mobiroller, Appypie, Appyourself, Buildfire, Goodbarber, Flutter
WEEK 10-13	SDG Decent Work and Economic Growth	1. Designing an online brochure/booklet/flyer or a poster 2. Integrating AR element onto this brochure/booklet/flyer or a poster	1. Canva, Stencil, Snappa, DesignBold, Lucidpress, Glogster, Easel.ly, Postermymwall, Gimp, Piktochart, PosterOven, Fotojet, Crello 2. Arize, Aurasma (HP Reveal), Blippar, Sketchfab, UniteAR, Augment
WEEK 14	Post-tests	Reflection papers	Semi-structured interviews

To this end, the first five weeks of the implementation is presented in the following while the other nine weeks are detailed in Appendix A.

Week 1 (October 12, 2020). To begin with, the pretests were employed by making use of Google Forms Survey and pre-interviews conducted with 15 volunteer students. Following the first lesson, students were informed about the PBL including the steps and process for half an hour. The learning outcomes and skills that learners were expected to acquire were introduced with the ICT-Assisted PBL plan. The students formed groups of four or five. For developing awareness on the SDGs, they discussed the biggest problems in the world today via using the project photos. Then, they made an online the interactive quiz on SDGs. Following this, students worked in groups to select three goals that they believed should be prioritized and to justify their

selections. As an out-of-class activity, half of the class to read an article on SDGs and the other half of the class to read another article about SDGs shared on Microsoft Teams. When the following class began, students were supposed to discuss the substance of the articles in pairs or small groups via working on breakout rooms on Teams.

Week 2 (October 19, 2020). The first lesson of the second week started via discussing the articles of the previous weeks. The lesson went on introducing the Global Goal 1- No poverty & 2-Zero Hunger, creating global goal icons for each and Project Action Plan activity. Via working on their own project groups, ss started to create icons for Global goal 1 and 2 to be used for their future web-site creation and made a detailed action plan to achieve Goal 1&2 on break-out rooms. They also created a spidergram showing solutions and giving justifications to SDGs as a group. The second lesson aims to promote awareness of the global phenomena of poverty and to investigate innovative strategies to shape learners' empathy and sensitivity to the needs of others. Ss discussed the quote of Mahatma Gandhi: "Earth provides enough to satisfy every man's need but not every man's greed." Following these, working on their project groups via break-rooms, ss discussed the material and non-material needs while reflecting on the question of wealth and poverty. In the third lesson, the class was again divided into their own project groups to work on three parts. They were asked to design a three-part poster. As an out-of-class activity, after discovering innovative strategies to develop learners' empathy and awareness to the needs of others, they wrote a short paragraph individually and uploaded to Microsoft Teams as an assignment. The last lesson included the Poem "All Alone" (Zabor-Żakowska, 2016) to cultivate students' empathy for the poor. After discussing the main idea of the poem individually, as a follow-up, ss to wrote a short letter on behalf of Scarecrow to a friend and transforming the poem into a story or writing a contrasting narrative of a prosperous and contented character. Ss had an opportunity to publish and use these letters and stories in the web-site they were expected to create. Ongoing feedback was given to each group from Microsoft Teams after they uploaded their assignments to EDMODO and Teams.

Week 3 (October 26, 2020). The first session of the third week began with an exercise called Issues with food, which was designed to get students thinking about potential sustainability concerns with common meals and to raise awareness of food-related issues. Ss employed break-out rooms to discuss environmental or social concerns that can be created by people consuming certain foods (chocolate, foreign tea and coffee, meat, palm oil, individually packed cookies). After that, ss matched the products, headings, and paragraphs by means of worksheet 1, 2, and 3 individually. Later, ss discussed the issues of “Child labour/slavery, Food miles, Overfishing, Loss of biodiversity, Fairtrade, Land clearing / hormones / antibiotics, Too much water in processing, Too much packaging” after reading the paragraphs and elaborating on more about the reasons and possible solutions to these particular problems within their project groups. As an out-of-class activity, ss investigated more on problems of food which were included in the worksheets and include this information in their future web-sites. The second session included an exercise called Action Newspaper & Protest Banners, which was designed to enhance awareness of food concerns such as hunger, malnutrition, and the food commodities market. Ss reviewed the meanings of words related to food speculation, waste, and global hunger within their project group, and evaluated the phrases in terms of relevance in today’s society. Each group of students was supposed to choose two of the five phrases, and search for an article. After reading the article, the volunteer groups shared their summaries in the very beginning of third lesson. The worldwide, national, and local activist organizations, such as Greenpeace and Change.org, were discussed in groups. Ss then discovered three intriguing activist campaigns relating to food from the organizations in groupings. The groups then shared their research with another group and decided on topics in which they became involved. To address the issue, such as petitions, posters, protests, and study, as well as the most critical aspects, in the last lesson, ss tried to design a newspaper front page by writing headlines relating to hunger, malnutrition, food commodity markets and summaries of the issues via adding digital drawings. Ss made use of these newspaper front pages for their final project and uploaded the revised version of their tasks to the TEAMS system.

Week 4 (November 2, 2020). The first lesson of the fourth week began with an

activity called PMI and tweets related with GM crops and maintaining genetic diversity. During this lesson SS debated whether “It’s a good idea to have GM crops or not.” Therefore, each project group explained and did an instant online research about what GM crops were. Ss were divided into three major groups in order to prepare as many points as feasible in 10 minutes (Group 1- positive plus point; Group 2- negative minus points; Group 3-interesting points). Ss were then given the relevant section of Worksheet 1 in order to generate further ideas, to choose the one that best expressed their point of view and to join other groups with another two or three people who broadly agree with them and write a few tweets to explain their arguments inside a group. The second lesson began with an Old Chinese fable called “The Seed of Justice,” which demonstrated that problems like poverty, hunger, inequity, and injustice are not insurmountable. Ss discussed the story and then created a functional present to story character. The third lesson comprised of an activity called Challenge for ending hunger and ensuring sustainable food systems and habits. Ss conducted some web research to find out about sustainable food sources within project groups after testing to see if they knew how to determine how sustainable food was by discussing and contrasting a few instances, e.g. local, seasonal veggies vs. imported, processed, packaged meat. Each group chose one of these topics for a class competition as a challenge including the most sustainable food diary, the most sustainable café menu and the greatest plan to eradicate poverty and malnutrition in the world. After choosing a challenge topic for their group, they worked on break-out rooms and delivered their final products within a week period and upload the final version of their task to Teams to be used for their final project presentations regarding their web-sites. The final lesson of the week included a pie chart exercise for examining global cuisines, hunger, and malnutrition. Ss sketched a rough pie chart of the percentages of meat, dairy products, and grain they ate and compared it to others by demonstrating, asking, and explaining it using their webcams after viewing ss Worksheet 1. Ss decided which students’ diets were a) the most nutritious and b) the most sustainable, i.e. best for the planet. Ss within groups discussed the points in Worksheet 2. Lastly, upon the interactive link of national geographic, they made research in project groups online. Each group chose two countries and compare their diets and discussed the reasons why, and any ideas they had for improving the diets. Ss could choose two different countries and compare their meat-eating habits and discuss how this affected the

environment by clicking on “meat consumption” to compare how much meat was eaten around the world, then use these for their presentations to the class next week as time was insufficient to complete the entire activity in-class. The main goal was to have ss think about how these issues linked to hunger and sustainability. As an extracurricular exercise, ss were also required to write a brief summary of what they had learned.

Week 5 (November 9, 2020). Week 5 included the presentations of the final public product of the projects, web-sites and delivering the problem solution essays concerning SDGs 1 and 2 (Zero hunger and No poverty). Each group comprising of four or five members was ready with available cameras and microphones for their presentations lasted for 20-25 minutes. While presenting their web-sites while some of the groups shared their screens and presented their web-sites directly; some of them started with ppts and then presented the web-sites they created. The group work and their collaboration, as well as their division of work was observed. The presentations were recorded on Stream. The presentations lasted for almost five hours and one more extra lesson was required to complete all of the presentations. In this regard, the session included five classes for the fifth week. Ss submitted a well-researched, well-articulated final project for evaluation, demonstrating their awareness of numerous global concerns and potential solutions. Each group presented their problem statement, the proposed solution, in at least twenty minutes to the entire class. The students were requested to revise their work at home and submit the final version of their web-sites and problem-solution compositions to Teams within a week.

3.5.3.2 Control Group Instruction. The implementation process in the control group included conventional teaching practices lasted for 14 weeks divided into 3 sections by means of Synchronous Online Courses on Microsoft Teams. As aforementioned, control group was kept similar to the experimental group in terms of the language input they received such as the reading texts, the content of the activities, and supplementary teaching aids. However, the instruction they received differed. To this end, contrary to the experimental group, teacher-driven traditional way of teaching was applied. On the other hand, control group students presented 3 powerpoint presentations and wrote 3 problem solution compositions on SDGs at the

end of each 4 weeks and were evaluated via rubrics. The first five weeks of the implementation is presented in the following whilst the other nine weeks are detailed in Appendix A.

Week 1 (October 12, 2020). The students were given the Self-Efficacy Scale for English and the Autonomous Learning Scale in order to measure their perceptions using a Google Forms Survey. All of the participants completed the online questions in less than half an hour. The students were also informed to work in groups of four and five during the semester to deliver 3 different tasks including 3 power point presentations regarding the solutions to SDGs and 3 problem solution compositions to be uploaded on Microsoft Teams. In that sense, timeline for their assignments and weekly syllabus as well as the grading system of the lesson were shared with the ss by means of the PPT presented by the teacher. The second lesson began with a brief introduction to the Global Goals. To introduce ss the UN's SDGs 2030, ss watched the video retrieved from YouTube and then matched the names of the goals with the simplified definitions and aims on Worksheet 1. In the third lesson, ss discussed the SDGs. Following that, the first half of the class read the first article and the second half of the class to read the second article, all of which were connected to the SDGs, and then took notes by summarizing the main points. Ss were instructed to describe the content of the articles to each other in pairs or small groups at the start of the next class. Lastly, for their three assignments, ss formed groups of four or five and filled in the form shared on Teams within a week period.

Week 2 (October 19, 2020). The first lesson of the second week started with brainstorming about Global Goal 1&2. After that ss, within their study groups, created a spidergram showing solutions and giving justifications to SDGs. They could benefit from online research while working together. Volunteer ss shared their ideas and what they found at the end of the lesson. In the second lesson, after introducing the target vocabulary, ss discussed Gandhi's quote: "Earth provides enough to satisfy every man's need but not every man's greed" within their study groups. Then, a representative student from each group shared their group opinions on this quote with the class. The third lesson began with illustrating the problem of inequality by using the photographs from National Geographics and volunteer ss talked about these

photos. The lesson went on with investigating the material, non-material, and basic human needs within study groups. After categorizing them, each group took notes and prepared a report to be used in their final task on SDGs 1 and 2. The last lesson began with teaching ss some vocabulary, e.g. struggle, bearing in mind. For introducing the poem “All Alone” (Sylvia Zabor-Żakowska, 2016), volunteer ss read the poem aloud. Upon discussing the main idea of the poem, ss answered comprehension check questions regarding the poem. Next, talked about their personal experiences of helping others. Lastly, ss were expected to write a paragraph on this individually.

Week 3 (October 26, 2020). The third week was related to the problems with food. The first lesson began with introducing the target Language focus (Yes/no questions, persuasion) to the ss. Then, upon discussing environmental or social problems that might be caused by people eating some of the specific foods individually, ss matched the products, headings, and paragraphs by means of worksheet 1, 2, and 3. Ss had a chance to eliciting/practice persuasive language such as “Why don’t you + inf?; You could try ...; It might be a good idea to ...” In line with this, ss practised with some examples trying to persuade someone to change their eating habits. The second lesson included activities including action newspaper & protest banners. In terms of hunger quiz and writing a news report, ss initially completed a quiz on the website for assessing students’ knowledge about hunger taking place in the world. They next reviewed their findings by giving their opinions on each of the quiz’s five questions individually. To active involvement in food issues, e.g. food security and hunger, ss were expected to create protest banners. In their study groups, ss decided on some real important things they wanted to say about environmental or social problems connected with food. The protests were explained by showing photographs of protests and banners. Then, each group created two or more protest banners, each with a message they might yell while marching during a protest, in the third class. The last session included a writing task in which the ss were asked to create a news story about poverty in their nation. To do this, ss formed study groups once more and decided on a spokesperson to present their news stories. When ss completed their reports, they shared these on Teams and EDMODO with the whole class.

Week 4 (November 2, 2020). The first lesson of the fourth week depended on PMI and tweets. Initially, ss brainstormed on what the GM products were. Via making an online research on GM products and discussing their pros and cons within they study groups, ss took notes. Then a representative student from each group presented their opinions and information they gained via online search. Upon teacher's introducing the target vocabulary, ss read the paragraphs on Worksheet and answer comprehension check questions. In the second lesson, ss summarized the positive plus, negative minus, and interesting points regarding GM products. Specifically, volunteer ss read their summaries. The class continued with an old Chinese story called "The Seed of Justice". Following the introduction of key vocabulary, ss read "The Seed of Justice", a famous Chinese fable in which a poor and starving elderly man stole a pear and the Emperor had to judge him and answer reading comprehension problems individually. The third lesson was based on an activity entitled challenge. After brainstorming about sustainable food sources and comparing some examples such as local, seasonal vegetables vs. imported, processed, packaged meat, each student was given one of the topics for a class competition as a challenge such as the most sustainable food diary, the most sustainable café menu, and the best plan to end hunger and malnutrition in the world. Ss presented their complete tasks in TEAMS to the whole class. Lastly, they were expected to select the most sustainable ones via voting them online on TEAMS. The last lesson was related with pie charts. Ss discussed several questions on Worksheet 2 and compared the eating habits using comparative forms. Finally, via clicking on 'daily diet' at the top to investigate and compare different countries, each student was supposed to choose two countries and compare their diets and discuss the reasons why, and any ideas they had for improving the diets. Finally, as a follow-up, they wrote a short summary of what they had learnt as an assignment and upload their drafts on TEAMS.

Week 5 (November 9, 2020). Week 5 included the presentations of the power point presentations regarding the solutions they investigated and delivering the problem solution essays concerning SDGs 1 and 2 (Zero hunger and No poverty). Each group comprising of four or five members was ready with available cameras and microphones for their presentations lasted for 20-25 minutes. The presentations lasted

for almost five hours were recorded on Stream and one more extra lesson was required to complete all of the presentations. For assessment, ss presented a well-researched group task, which demonstrated their understanding of various global challenges and potential solutions. Each group presented their problem statement, the proposed solution, in at least twenty minutes to the entire class. The students were asked to refine their work at home and submit the final version of their slides and their problem solution compositions within the week on Teams.

3.5.4 Data analysis procedures. In this section, both quantitative and qualitative data analysis techniques used in the present study were presented in detail. For the purposes of the study, data collected from previously mentioned instruments were analyzed by means of the combination of quantitative and qualitative methods which Lynch (1996) calls as a mixed study design for providing more complete and in-depth understanding of research problems as data was validated through the triangulation of different instruments.

3.5.4.1 Analysis of the quantitative data. Different scholars (Altman & Bland, 1995; Pallant, 2007; Uttley, 2019) stated that, with large enough sample sizes (> 30 or 40), the assumption of normality can be ignored and a parametric test can be used as the distribution of the sample is accepted to be normal. According to Uttley (2019, p.153), “this is due to the central limit theorem, which states that the means of a random set of samples from a population approach normality as the size of the sample increases. Sample sizes of $N \geq 30$ generally produce a normal distribution of sample”. Although the sample size in this study is over than 30, initially, the data were examined regarding normality and outliers. In order to check any violations inherent in data and assess whether a distribution is normal or not, tests of normality for the relevant variables were conducted through skewness and kurtosis values. In that sense, skewness and kurtosis values are assumed to yield a normal shape for the distribution of the data when the -2 to +2 levels are accepted as reference as given in George and Mallery (2010). The results indicated that for each pre and post-tests of every single questionnaire, the data followed a normal distribution (-2 to +2) (Appendix R). Therefore, parametric tests were warranted. Additionally, no outliers or missing scores were detected.

The quantitative data collected through surveys, project products, writing and speaking scores based on students' problem solution essays and presentations were analyzed by Statistical Package for the Social Sciences (SPSS) 24.0. Regarding the first research question aiming to find out a difference in students' 4C levels after the PBL, students' first and third project products and presentations were evaluated by means of a series of rubrics. As for collaboration skill, the students were evaluated by their team members according to the rubric prepared by Intel Teach Program (2010) (Appendix K). The rubric includes six parts: "Leadership, participation, feedback, listening, cooperation and time management" (Intel Teach Program, 2010). The group members used the rubric to evaluate each other and a short training was given to them on how to use and score the rubric. For communication skill, Public Speaking Competence Rubric developed by Schreiber et al. (2012) (Appendix M) was adapted by the researcher and students' public product presentations were evaluated by two raters. Reliability level of the rubric was $>.7$. The rubric comprises eleven questions that attempt to determine the students' performance on public speaking. Thirdly, Holistic Critical Thinking Scoring Rubric developed by Facione and Facione (1994) (Appendix J) was utilized for evaluating the critical thinking skills of the students. Specifically, two raters assessed each project products using a four-point scale ranging from 1 (poor) to 4 (strong), which regards critical thinking as a set of cognitive skills bolstered by specific personal dispositions. For instance, one of the project groups consisting of four people developed a project called "the Secret Hand" on SDG 1 No Poverty and SDG 2 Zero Hunger to prevent food waste and end hunger. In order to reach their goal, they created a website called "Gleam of Hope". They made use of photos in order to present each step of their solutions. The project product was evaluated by two interrater separately by means of the rubric and some of the notes taken by the raters are indicated in figure 9:

GLEAM OF HOPE <https://4gleamofhope.wixsite.com/website/problem-solution>

SECRET HAND

The solution we thought and developed to put an end to hunger was the Secret Hand Project. When we think of people who do not have the money to buy food, we can create drawer stands in the non-visible part of the restaurants in a way that is not visible from the inside. Restaurant staff will pack uneaten food during the day and place it in compartmentalized drawers. Needy people will be able to get the food they want from the drawers. While these are happening, the person giving the food and the person receiving the food will not see each other. Needy people are often hesitant about this issue. So we think this could be good.

→ offers alternative points

→ Justifies reasons

→ explains reasons

justifies procedures

Let's talk about how the project will come to life. A report with project details and draft pictures will be sent to municipalities, charities or some aid companies. The details and budget will be discussed with the restaurant that accepts the project. Stands will be set up in restaurants. Advertisement of the project will be done in the city. The plan of the project will be added to the restaurant menus. The project will be advertised in the city. Thus, people will be able to aware of the project and if they would like, they will be a part of this project and support it.

→ offers alternative points

→ Justifies reasons

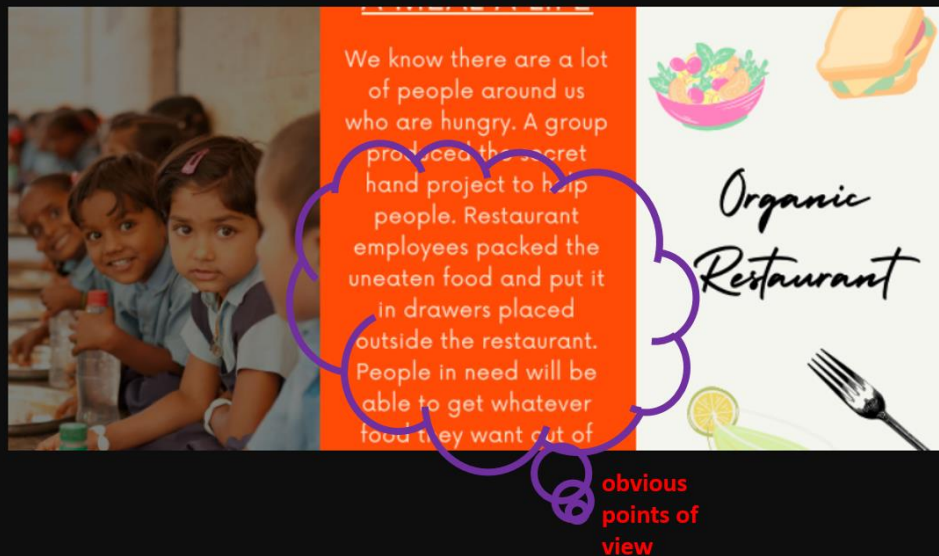
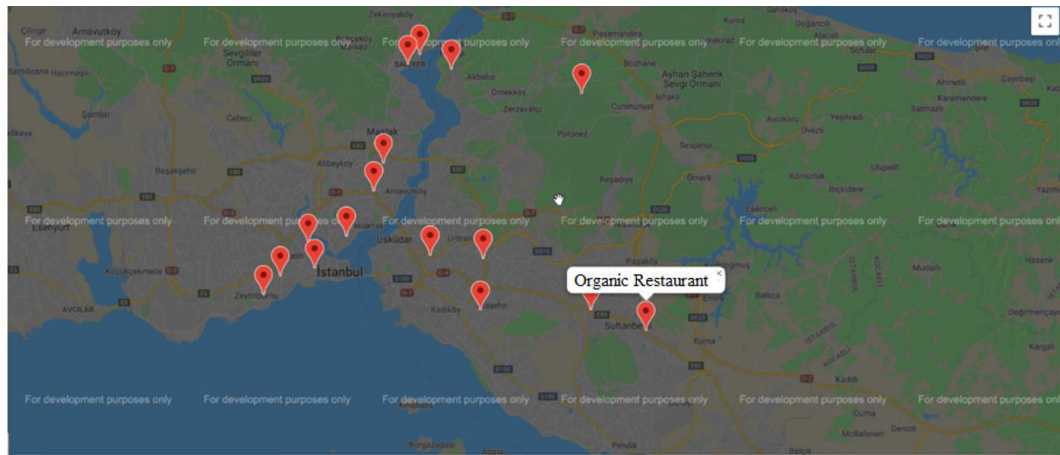


Figure 9. Sample of Students' web-site



With our web-site, people who need help and who want to donate food can easily find the locations of the charity restaurants.

→ Justifies reasons

Figure 9. (cont.) Sample of students' web-site

Lastly, the Creative Thinking rubric (based on KPM, 2010), cited in Kuong et al. (2012) (Appendix L) was used to evaluate the products of the students (Appendix N). The rubric consists of five concepts: “Sensitivity, fluency, flexibility, elaboration, and originality” based on (KPM, 2010), cited in Kuong et al. (2012) and the participants were assessed out of 20 points by two raters as indicated in figure 10. The second rater is also expert in the field and experienced with teaching and assessment in ELT. For instance, one of the groups created an AR-Integrated Brochure for their project called “Farmcust” in order to solve SDG 8 Decent Work and Economic Growth. In their brochure, via QR Code, they guided the customers to the web-site they created which is about buying and selling organic products. With Farmcust, without a broker, the public could get their food directly from the farmer. In this way, the farmer gets the reward of his labor, and the people receive the product at its real price and by seeing it. Farmers, on the other hand, specify which plants they grow and sell this year before the crops begin to be produced. From the moment the first seed is planted, the stages of growing the product, the amount of water they use, the amount of fertilizer, they report things to the site. Also, buyers do not have to pay extra. The person who reaches the product is able to instantly see where the food comes from and how it is produced by reading the barcode on the top of the package.



Figure 10. Sample of Students' AR-Integrated Brochure

Then, the scores were analyzed by means Paired Sample T-tests. In addition, Essential Project Design Elements Checklist (Appendix O) developed by Buck Institute for Education (2019) was completed by the researcher who was also the lecturer of the programme regarding each of the projects. The checklist comprises of elements such as “key knowledge, understanding, and success skills, sustained inquiry, challenging problem or question, authenticity, student voice & choice, reflection critique & revision, public product” (Buck Institute for Education, 2019).

Regarding the second research question, the final versions of experimental and control group students' first and third problem solution essays were evaluated by the

researcher and a second rater using the B1 Writing Assessment Scale developed by Cambridge English Language Assessment with explicit reference to the Common European Framework of Reference for Languages (CEFR). It is divided into four subscales including Content, Communicative Achievement, Organization, and Language (Appendix H) and has six bands ranging from 0 to 5, with 0 being the lowest and 5 being the highest. For bands 1, 3, and 5, descriptors for each criterion are supplied, indicating what a candidate should exhibit at each band. The characteristics for bands 3 and up typically reflect a B1 level of performance. To find out the differences between the experimental and control group in terms of their L2 writing performance, Independent Samples T-test was used to analyse the scores of problem solution essay writing. In a similar vein, for finding out whether there is a statistically significant difference between experimental and control groups in terms of their L2 speaking performance, the students in both groups were asked to make presentations regarding their solutions to SDGs. The experimental group was expected to present their projects and public products they created in relation to the SDGs whilst the control group was supposed to create powerpoint presentations with reference to their solutions to the SDGs. First and third speaking performances of the students were evaluated by two raters independently by means of the B1 Level Speaking Assessment Rubric created by Cambridge English Language Assessment which is divided into six bands ranging from 0 to 5, with 0 being the lowest and 5 the highest (Appendix I). For bands 1, 3, and 5, descriptors for each criterion are supplied, indicating what a candidate is expected to exhibit at each band. The characteristics for bands 3 and up typically reflect at least a B1 level of performance. It includes four sub-sections as grammar and vocabulary, discourse management, pronunciation, and interactive communication. To find out the differences between two groups, Independent Samples T-test was used to analyse the speaking scores of presentations. Agreement between two raters was evaluated via ICC (Intraclass Correlation Coefficient). Summary of data evaluation tools for the first and second research questions are presented in figure 11.

Skills	Data Collection	Data Evaluation
Collaboration	Project Products (Web-site, AR-Integrated Brochure)	Peer Assessment Collaboration Rubric (Intel Teach Program, 2010)
Creativity	Project Products (Web-site, AR-Integrated Brochure)	Creative Thinking Rubric (based on KPM, 2010, cited in Kuong et al. 2012)
Critical Thinking	Project Products (Web-site, AR-Integrated Brochure)	Critical Thinking Scoring Rubric (Facione & Facione, 1994)
Communication	Presentations	Communication Skills Rubric (Schreiber et al., 2012)
L2 Writing	Problem Solution Essays	B1 Level Writing Assessment Rubric
L2 Speaking	Presentations	B1 Level Speaking Assessment Rubric

Figure 11. Summary of data evaluation tools

Also, Independent Samples T-tests were used to analyze the data obtained by means Self-Efficacy Scale for English (Üstünlüoğlu, Bümen & Öğretmen, 2018), and Autonomous Learning Scale (Arslan & Yurdakul, 2015) investigating whether there was a statistically significant difference between experimental and control group of students regarding their pre and post test scores in terms of third, and fourth research questions. During the analysis, none of the questionnaires had reverse coded items. Regarding the fifth research question aiming to find out students PBL qualifications and perceptions of 21st century skills, data obtained by means of Project Based Learning Scale (Tuncer & Yılmaz, 2013) and 21st Century Skills Scale (Yılmaz & Alkış, 2019) were analyzed by means of Paired Sample T-tests. In addition, to find out student' perceptions on each item, descriptive statistics were applied to the data.

As Lakens (2013) suggested, while analyzing the quantitative data, statistical significance could be used to test a predicted impact of any intervention. For the current research, the .05 level is accepted as a cut-point for statistical significance ($p < .05$). As statistical significance is related with that the observed difference between the two scores could occur by chance, it is significant to describe the results regarding measures of magnitude of an intervention (Hoekstra et al., 2014), necessitating a researcher to calculate the effect size of the observed difference (Maher et al., 2013).

The effect sizes of tests were computed based on Cohen's *d* criteria, "a standard measure used to determine if the obtained value of data represents a small, medium, or large effect" (Pagano, 2009, p. 339). In this vein, both the substantive significance indicating "the pure strength of the measured relationship" (Huck, 2012) via illustrating "the practical significance of the research (effect size) and the statistical significance (P value) for complementary analyses are to be reported" regarding the findings of a study (Fan, 2001; Fidler & Cumming, 2012; Rosnow & Rosenthal, 2009). Given this, in order to determine the effect size of the PBL on the participants, "Cohen's *ds* were computed based on the formulas on a spreadsheet" prepared by Thalheimer and Cook (2002). The same procedure was applied for the analysis of each questionnaire in the light of the data obtained from the pre and post-tests.

3.5.4.2 Analysis of the qualitative data. In order to gather ample evidence to the sixth research question aiming to find out students' opinions on ICT-Assisted PBL, multiple methods of qualitative data collection tools including written reflections of students and interviews were analyzed by Content Analysis (Creswell, 2012). All interviews were transcribed and these transcriptions, along with written-reflections of the students were collectively exploited for data analysis. In line with this, regarding the last research question investigating the perceptions of the lecturer on the implementation of the ICT-Assisted PBL, field notes kept by the researcher was also analyzed through Content Analysis, which refers to "a research method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005, p. 1278). According to Elo and Kyngäs (2008), Content Analysis depends on three phases including preparation, organizing, and reporting as indicated in Figure 12 and the same process was followed in the current study.

Preparation

Being immersed in the data and obtaining the sense of whole, selecting the unit of analysis, deciding on the analysis of manifest content or latent content.

Organising

Open coding and creating categories, grouping codes under higher order headings, formulating a general description of the research topic through generating categories and subcategories as abstracting.

Reporting

Reporting the analysing process and the results through models, conceptual systems, conceptual map or categories, and a story line.

Figure 9. Analysis phases and their descriptions on content analysis (Elo & Kyngäs, 2008, p. 110)

As suggested by Thomas (2006), independent parallel coding was employed with the aim of sustaining coding consistency. During this process, two coders developed different sets of initial sub-categories derived from the raw data and followed the similar procedure independently. Then, different sets of sub-categories were compared and the final sub-themes/categories were negotiated. Upon debriefing with the same inter-coder, who completed his PhD in the same field and expert in qualitative data analysis, the findings were discussed and there was a high agreement on codes and categories.

3.5.5 Reliability, validity, and trustworthiness. In any study, the reliability and validity of quantitative methods, as well as the trustworthiness of qualitative approaches, are major concerns.

3.5.5.1 Reliability and validity in quantitative data. Validity relates to the truthfulness, demonstrating how well it aligns with actual reality, whilst reliability refers to the consistency or dependability of an instrument, including stability, internal consistency, and equivalency (Neuman, 2014). Content, construct, internal, and external validity are the most frequently types of validity addressed in qualitative and quantitative research (Cohen, Manion, & Morrison, 2007). Content and construct validity in this current research was basically maintained by the use of questionnaires

including Self-Efficacy Scale for English (Üstünlüoğlu, Bümen & Öğretmen, 2018), Autonomous Learning Scale (Arslan & Yurdakul, 2015), Project Based Learning Scale (Tuncer & Yılmaz, 2013), 21st Century Skills Scale (Yılmaz & Alkış, 2019) adapted from studies conducted in a similar context with the context of this study. Additionally, the questionnaires were pilot tested with 220 EFL students sharing the same characteristics with the actual participants as representing the target group before employed to the target participants. Regarding the external validity, the present research was conducted in a context representing the similar features of EFL programs in Turkey with similar groups of students, similar English proficiency levels, in similar periods representing the population.

Reliability is significant in research to reduce errors during the analysis of questionnaire responses (Creswell, 2012). In educational contexts, reliability refers to a test's internal consistency, which is measured in general by the Cronbach alpha value, also known as coefficient alpha (Cronbach, 1951). In the present study, quantitative data were collected through the use of different Likert Type questionnaires. In order to measure the reliability of these questionnaires, Cronbach alpha value was estimated for each of them and it was found to be .84 for the ALS, .81 for the 21st Century Skills Questionnaire, .92 for PBL Qualifications Scale, and .92 for Self-Efficacy Scale for English. As suggested by Nunnally and Bernstein (1994) the acceptable magnitude of Cronbach alpha is .70 and above. Grounded on this, each questionnaire employed in this study had acceptable reliability value.

Following, to find out the inter-rater reliability, “the intraclass correlation coefficient (ICC) which is a widely used reliability index in test-retest, intrarater, and interrater reliability analyses reflecting both the degree of correlation and agreement between measurements of continuous data” (Koo & Li, 2016, p.1) was used for the analysis of each rubric (Creative Thinking Rubric (based on KPM, 2010, cited in Kuong et al. 2012); Communication Skills Rubric (Schreiber et al., 2012); Critical Thinking Scoring Rubric (Facione & Facione, 1994); B1 Level Writing and Speaking assessment rubric created by Cambridge English Language Assessment). A two-way mixed effect model based on multiple ratings and absolute agreement assessed the inter-rater reliability. Means estimations along with 95% confidence intervals (CI)

were reported for each ICC. For the current research, interpretation was as follows: “<0.50, poor; between 0.50 and 0.75, fair, between 0.75 and 0.90 good; above 0.90, excellent” (Koo & Li, 2016, p.1). Accordingly, for each scale, the ICC for interrater reliability was between good and excellent reliability.

The final analyses were conducted to determine the test-retest correlations which refer to the repeatability between consecutive sessions taken by the same instrument under the same conditions (Perinetti, 2018). In many situations these correlations serve as useful indicators of the stability of scores over time. In order to measure reliability for two tests, the Pearson Correlation Coefficient was used for the current research. Test-retest reliability coefficient varies between 0 and 1 where 0-0.19 is regarded as very weak, 0.2-0.39 as weak, 0.40-0.59 as moderate, 0.6-0.79 as strong and 0.8-1 as very strong correlation. Accordingly, the test-retest correlation for the each scale was very strong. The results of the normality tests, inter-rater reliability, and test-retest reliability of each scale were presented in detail (Appendix R).

3.5.5.2 Trustworthiness in qualitative data. Four best-known key components of trustworthiness that qualitative research must establish include credibility, transferability, dependability, and confirmability according to Lincoln and Guba (1985).

As claimed by Lincoln and Guba (1985) several techniques could be used to address credibility including prolonged engagement, persistent observation, data collection triangulation, researcher triangulation, peer debriefing, member checking.

In this study, the credibility was operationalized in a number of ways. First, in terms of prolonged engagement, the researcher had long-lasting engagement in the context with participants and invested adequate time to be familiar with the setting and context, to check misinformation, form trust, and get to know the data to get rich data. As the researcher was an experienced EFL instructor in the institution, she had an in-depth understanding the features of the participants and the institution. Being familiar with the context thanks to her relevant background and experience with these students for two years enabled her to figure out the reality of the context and participants.

Regarding, persistent observation, she had a chance to identify relevant issues under study and focus them in detail. Additionally, triangulation was maintained by means of using different data collection tools such as interviews, written reflections, and field notes “to obtain different but complementary data on the same topic” (Morse, 1991, p. 122). Investigator triangulation is ensured by using two researchers for coding, analysing and interpreting decisions, whilst method triangulation was achieved via using multiple methods of data collection such as quantitative and qualitative. In a similar vein, member checking (Birt et al., 2016), “the process of continuous, informal testing of information by soliciting reactions of respondents to the investigator’s reconstruction of what he or she has been told or otherwise found out” (Schwandt, Lincoln & Guba, 2007 p. 19) was accomplished after the data collection process to test the findings and interpretations with the participants. After conducting the semi-structured interviews, the participants were asked to read the full transcriptions to check whether they were in accordance with what they intended to express or not and consider whether they matched what they actually meant as suggested by Nguyen (2014). Participants had a chance to revisit their responses for accuracy and acquire therapeutic benefits (Creswell, 2012) thanks to the confirmation for the accuracy of what was told in the interviews. The researcher and respondents looked at the data with different eyes after feeding back data, analytical categories, interpretations, and conclusions to members of the groups from whom the data were initially gathered and this strengthened the data. This technique was also useful to verify emerging theories and inferences (Shenton, 2004) made by the researcher and suggested by scholars (Brewer & Hunter, 2006; Miles & Huberman, 1994). Also, peer debriefing provided an external check for the researcher on the research process to determine if the inferences were logical, the themes are appropriate and the findings are grounded in the data or not (Jeanfreau & Jack, 2010).

Transferability refers to the generalizability of inquiry and could be achieved via providing thick descriptions so that the findings could be transferred to the own sites of the researchers who seek for them (Lincoln & Guba, 1985). In this study, not only the experiences and behaviors but also the context was described in detail via thick description so that they became meaningful to outsiders, other researchers and practitioners in similar EFL contexts willing to replicate the study.

In terms of dependability, the research process ensured to be logical and clearly documented (Tobin & Begley, 2004). While examining the research process, the readers could judge the dependability of the research (Lincoln & Guba, 1985). Audit trail (Koch, 1994) is one way of achieving dependability and used for describing the research steps transparently and reporting of the findings. To demonstrate the dependability in this research, all the necessary information in relation to the features of participants, research setting, data collection instruments, and data analysis procedures were described in detail. The records of the research path were also kept throughout the study and the online lessons were recorded to Microsoft Stream during implementation process. By means of keeping records of the raw data, field notes, transcripts, the researcher in this study aimed not only systemize and cross-reference data, but also simplify the reporting of the research process for creating a clear audit trail as well as suggested by Halpren (1983).

Confirmability is related to the objectivity of the research (Patton, 2002) and its goal is to prove that the researcher's conclusions and interpretations are clearly drawn from the data (Tobin & Begley, 2004). It could only be achieved once trustworthiness, transferability, and dependability had all been established (Guba & Lincoln, 1989). As Koch (1994) suggested via providing justifications for theoretical, methodological, and analytical choices throughout the entire study, the researcher in this study aimed to enable others' further understanding on how and why decisions were made. To ensure the objectivity, triangulation based on a collection of multiple sets of data (Creswell, 2012) as well as keeping a reflexive journal were utilized by the researcher for eliminating biases and presuppositions.

3.6 Ethical Considerations

With the aim of conducting an ethical study, ethical issues including reciprocity, confidentiality, anonymity were taken into consideration by means of a checklist adapted from Patton (2002) and ethical standards were met in different ways.

Initially, Ethical Approval was taken from both Bahçeşehir University Board of

Scientific Research and Publishing Ethics and Kırklareli University Board of Scientific Research and Publishing Ethics (Appendix Q). In relation with these, Institutional Consent was also taken from Engineering Faculty of Kırklareli University.

Secondly, informed consents were taken from both the experimental and control group students and interrater (Appendix P) at the beginning of the study before data was collected to ensure the ethical standards. The consent forms comprised of detailed information such as the purpose of the study, procedures, confidentiality, expectations from the participants and the right to withdraw. The participants were informed that the participation in this study was voluntary and ensured that they could withdraw from the study any time they want without repercussion. All participants were also informed that they could get further information about the details of the study from the researcher, and get in touch with the university ethical board for further inquiries.

To ensure the confidentiality, all of the participants and documents were protected against being discovered from others. Soft copies of collected data were stored in password-protected files whilst, hardcopy forms of data were also kept locked away.

Anonymity was maintained while collecting both qualitative and quantitative data. For the quantitative phase, the questionnaires were obtained without the names of the participants. In this regard, all the questionnaires were anonymous and each questionnaire was given numbers for data analysis. Each participant's identity was protected in the research report by mentioning them using numbers instead of their names during the implementation process of the research. For the qualitative phase of the study, pseudonyms were used in order to conceal the participants' identities.

3.7 Limitations

This study yielded significant findings regarding the use of ICT-Assisted PBL in EFL pedagogy. In the present study, although the data were triangulated by means of multiple data collection tools including questionnaires, interviews, written reflections and field notes and were carefully analyzed through various analysis

procedures; it must be acknowledged that there were potential limitations that were impossible to avoid regarding the inherent characteristics of the research design, data collection tools, researcher and participants.

First of all, as aforementioned in the methodology, the study adopted a quasi-experimental design, one of the most frequently employed designs in education research, including non-random assignment of participants to experimental and control groups and a frequently used. However, a naturally formed and already existing classroom could also be advantageous for representing the most suitable context and research setting as suggested by (Mackey & Gass, 2005).

One of the limitations of the study was related to the sample size of the participants. As aforementioned, in this study, there were 120 students divided into one experimental and one control group. More reliable, valid, and generalizable results could be obtained with a larger sample size including more experimental and control groups.

When the participating students are considered, Hawthorne effect could be seen referring to participants' favourable and positive behaviours or responses due to their awareness of taking part in an experiment. However, a semester long data collection process which lasted for 14-week implementation period could minimize the Hawthorne effect as the participants felt more comfortable and adapt to this process (Mellow, Reeder & Forster, 1996).

Another limitation might be that the researcher was an insider working as a lecturer and implementing the ICT-Assisted PBL, which may reduce objectivity and neutrality. However, in order not to unintentionally manipulate the students' success during the treatment, she took field-notes and considered the students' progress in a more in-depth manner while scoring their projects by means of rubrics. The researcher, also as the practitioner, analyzed the data with another rater to provide the objectivity of the data analysis. In line with these, member checking and peer debriefing were achieved to eliminate any possible researcher bias.

The last limitation might be related to the use of data collection instruments requiring the self-reported information of participants such as written reflections and semi-structured interviews. As the participants may be subjective and biased while reflecting on their own experiences regarding ICT-Assisted PBL, they could manipulate some of their ideas on specific issues so as to attract the instructor. To minimize this limitation, the researcher informed the students that there were not one correct answer of the open-ended questions and prompts. The students were also reminded that their names wouldn't be taken into account while analyzing their responses. In the same vein, students are guaranteed that their honesty and being objective was very significant to evaluate the process and for the sake of the correct feedback upon the treatment. The triangulation of the data collection instruments was another way to get rid of this limitation. For instance, to explore students' opinions on ICT-Assisted PBL and examine its impact on students' L2 productive skills as well as 21st century skills, not only qualitative data via written reflections, pre and post semi-structured interviews but also quantitative data through various questionnaires were collected and analyzed via making use of multiple techniques.

In summary, these limitations could be taken into account while interpreting the results and replicating the study in similar contexts to eliminate and minimize these restrictions.

Chapter 4

Findings

4.1 Introduction

This chapter provides the presentation of the data findings with reference to each research question mentioned previously. In this regard, the chapter includes two main sections for seeking answers to both qualitative and quantitative research questions.

4.2 Findings for Research Question 1

The first research question was addressed to determine whether there is a statistically significant difference between the 4C levels of the participants before and after being exposed to ICT-Assisted PBL. In order to answer the first research question, experimental group students' first and third ICT-Assisted projects including creating a web-site and AR-integrated brochure were evaluated by means of a series of rubrics. The scores gained by means of rubrics were analyzed by means of paired sample t-tests.

4.2.1 Critical thinking. Students' first and third project products (Appendix N) including the web-page on no poverty and zero hunger and AR integrated brochure on decent work and economic growth were evaluated by means of " Holistic Critical Thinking Scoring Rubric" (Facione & Facione, 1994). According to Facione and Facione (1994), the items which indicate high critical thinking level show that a student

- accurately interprets evidence, statements, graphics, questions,
- identifies relevant reasons,
- offers analyses of obvious alternative points of view,
- justifies some results or procedures, explains reasons,
- fairmindedly follows where evidence and reasons lead (Appendix J).

In order to explore whether the ICT-Assisted PBL was effective on students'

level of critical thinking skills, a paired samples t-test was conducted. The effect is reported by taking both statistical and practical significance of their results into account. Based on the results of the paired samples t-test (Table 6), the differences between pre and post-tests were statistically significant in terms of students' level of critical thinking skills ($t(59) = -29.500$, $p < .05$; Cohen's $d = 3.05$). The obtained findings indicated that the researcher rejected the null hypothesis and there was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 3.05$) showed that the ICT-Assisted PBL had a huge effect on students' level of critical thinking skills according to Cohen's criteria.

Table 6

Paired Samples T-test Statistics of Critical Thinking Rubric

	N	M	SD	t	df	P	Cohen's d
Pre-Critical Thinking	60	1.58	.519	-29.500	59	.000*	3.05
Post-Critical Thinking	60	3.25	.586				

* $p < .05$

4.2.2 Collaboration. Each student was evaluated by another group member by means of using "Peer Assessment Collaboration Rubric" (Intel Teach Program, 2010) in terms of taking part in activities, being a leader, listening to the pair, providing feedback, cooperating with the pair, and managing time (Appendix K). As the highest indicator of collaboration skills, the rubric includes items such as

- My pair took part in fully, and he/she was always with me while doing the task;
- My pair helped me a lot with a positive attitude and with solutions;

- My pair listened to me in a careful manner;
- My pair was able to share a detailed And Constructive Feedback when it was the right time.

In order to explore whether the ICT-Assisted PBL was effective on students' level of collaboration skills, a paired samples t-test was conducted. Based on the results of the paired samples t-test (Table 7), the differences between pre and post-tests were statistically significant in terms of students' level of collaboration skills ($t(59) = -14.287$, $p < .05$; Cohen's $d = 1.92$). The results showed that the researcher rejected the null hypothesis and there was statistically significant difference between the means of the paired t-tests for collaboration skill. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.92$) demonstrated that the ICT-Assisted PBL had a huge effect on students' level of collaboration skills.

Table 7
Paired Samples T-test Statistics of Collaboration Rubric

	N	M	SD	t	df	p	Cohen's d
Pre-Collaboration	60	2.20	.659	14.287	59	.000*	1.92
Post-Collaboration	60	3.27	.446				

* $p < .05$

4.2.3 Creativity. Students' first and third project products (Appendix N) including the web-page on no poverty and zero hunger and AR integrated brochure on decent work and economic growth were also evaluated by means of Creative Thinking Rubric" (based on KPM, 2010, cited in Kuong et al. 2012). The rubric assesses students' creativity in terms of being sensitive, fluent, flexible, elaborate, and original. The items, which are the indicators of high level of creativity includes:

- Being thoughtful towards diversities;
- Sufficient ideas are presented related to the task;
- Effectively present several descriptions, examples relevant to the task;
- Idea presentation is successful and intelligible (Appendix L).

In order to explore whether the ICT-Assisted PBL was effective on students' level of creativity levels, the paired samples t-test was conducted. Based on the results of the paired samples t-test (Table 8), the differences between pre and post-tests were statistically significant in terms of students' level of creativity skills ($t(59) = -33.253$, $p < .05$; Cohen's $d = 2.57$). The obtained statistics revealed that the null hypothesis is rejected as there is statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 2.57$) indicated that the ICT-Assisted PBL had a huge effect on students' level of creativity.

Table 8

Paired Samples T-test Statistics of Creativity Rubric

	N	M	SD	t	df	p	Cohen's <i>d</i>
Pre-Creativity	60	8.1	2.579	-33.253	59	.000*	2.57
Post-Creativity	60	15.11	2.908				

* $p < .05$

4.2.4 Communication. Students' first and third project presentations regarding the web-page on no poverty and zero hunger and AR integrated brochure on decent work and economic growth were evaluated by means of "Communication Skills Rubric" (Schreiber et al., 2012). According to Schreiber et al. (2012), the rubric indicates that an advanced student

- selects a topic appropriate to the audience and occasion;
- formulates an introduction that orients audience to topic and speaker; uses an effective organizational pattern;

- locates, synthesizes, and employs compelling supporting materials; develops a conclusion that reinforces the thesis and provides psychological closure;
- demonstrates a careful choice of words; effectively uses vocal expression and paralanguage to engage the audience;
- demonstrates nonverbal behavior that supports the verbal message;
- successfully adapts the presentation to the audience;
- skillfully makes use of visual aids; constructs an effectual persuasive message with credible evidence and sound reasoning (Appendix M).

In order to explore whether the ICT-Assisted PBL was effective on students' level of communication skills, the paired samples t-test was conducted. Based on the results of the conducted Paired Samples T-test (Table 9), the differences between pre and post-tests were statistically significant in terms of students' level of communication skills ($t(59) = -14.899$, $p < .05$; Cohen's $d = 1.66$). Based on the obtained statistics, the null hypothesis was rejected and there was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.66$) indicated that the ICT-Assisted PBL instruction had a huge effect on students' level of communication skills according to Cohen's criteria.

Table 9

Paired Samples T-test Statistics of Communication Rubric

	N	M	SD	T	df	p	Cohen's d
Pre-Communication	60	2.03	.603	-14.899	59	.000*	1.66
Post-Communication	60	3.05	.636				

* $p < .05$

To conclude, the results of the first research question revealed that there were statistically significant differences in students' level of 4C skills in all dimensions (critical thinking, collaboration, creativity, communication) after being exposed to the ICT-Assisted PBL instruction. Additionally, for the practical significance, in all

dimensions of the 4C skills, there was a huge effect of ICT-Assisted PBL instruction as reported with the Cohen's *ds* (Critical Thinking, 3.05; Collaboration, 1.92; Creativity, 2.57; Communication, 1.66). However, when the obtained Cohen's *ds* are compared, it is obvious that the effect of the treatment on each sub-dimension is different. While the highest number of the reported effect of the ICT- Assisted PBL is for critical thinking skill, the lowest one is for communication.

4.3 Findings for Research Question 2

The second research question aimed to investigate whether there is a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their productive skills in L2. In this regard, experimental group students' presentations on their ICT-Assisted projects and their problem-solution compositions were evaluated by means of B1 Level Writing (Appendix H) and Speaking assessment (Appendix I) rubrics created by Cambridge English Language Assessment whilst control group students' power-point presentations and problem solution compositions on SDGs were also evaluated via using the same holistic writing and speaking rubrics. The scores gained by means of rubrics were analyzed by means of both independent samples t-tests and paired samples t-tests respectively.

4.3.1 Effects on speaking skills. The presentations of students were evaluated by means of B1 Level Speaking Assessment Rubric (Appendix I) created by Cambridge English Language Assessment in terms of grammar and vocabulary, discourse management, pronunciation, and interactive communication. The items which indicates the highest score mean that the student

- shows a good degree of control of grammatical forms,
- uses a range of appropriate vocabulary to exchange views on familiar topic,
- uses range of cohesive devices,
- pronunciation is intelligible,
- initiates and responds appropriately,
- maintains interaction.

4.3.1.1 Comparison of pre-test scores of the control and experimental groups

in terms of their speaking skills. In order to explore whether there was a statistically significant difference between control and experimental group students' in terms of pre- speaking scores before receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-test was conducted. Based on the results of the independent samples t-test (Table 10), the differences between both groups were not statistically significant in terms of students' level of pre-speaking skills ($t(118) = .000$, $p > .05$). The results indicated that there was no statistically significant difference between both groups in terms of their speaking skills before the implementation.

Table 10

Independent Samples T-test Statistics of Pre- Speaking Skills (Experimental & Control Group)

	N	M	SD	T	df	p
Pre-test_Control	60	2.39	.765	.000	118	1.000
Pre-test_Experimental	60	2.39	.814			

* $p < .05$

4.3.1.2 Comparison of post-test scores of the control and experimental groups in terms of their speaking skills. In order to explore whether there was a statistically significant difference between control and experimental group students in terms of post- speaking skills after receiving either traditional or ICT- Assisted PBL instruction, an independent samples t-test was conducted. Based on the results of the independent samples t-test (Table 11), the differences between both groups were statistically significant in terms of students' level of speaking skills ($t(118) = -8.276$, $p < .05$, Cohen's $d = 1.52$). The findings indicated that the researcher rejected the null hypothesis and there was statistically significant difference between the means of both groups in terms of their speaking levels. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.52$) showed that the ICT-Assisted PBL had a huge effect on students' level of speaking skills for the experimental group compared to the control group who followed traditional way of instruction.

Table 11

Independent Samples T-test Statistics of Post- Speaking Skills (Experimental &

Control Group)

	N	M	SD	T	Df	p	Cohen's <i>d</i>
Post-test_Control	60	3.05	.986	-8.276	118	.000*	1.52
Post-test_Experimental	60	4.28	.585				

* $p < .05$

4.3.1.3 Comparison of pre-test and post-test Scores of the control group in terms of their speaking skills. In order to explore whether there was a statistically significant difference between control group students' pre and post speaking scores after receiving traditional instruction or not, the paired samples t-test was conducted. Based on the results of the paired samples t-test (Table 12), the differences between pre and post- tests were statistically significant in terms of students' level of speaking skills ($t(59) = -9.298$, $p < .05$; Cohen's $d = 0.75$). The findings indicated that there was statistically significant difference between the means of the paired t-tests for the control group. As for practical significance, the obtained Cohen's d (Cohen's $d = 0.75$) showed that the traditional instruction had a large effect on students' level of speaking skills for the control group.

Table 12

Paired Samples T-test Statistics of Speaking Skills (Control Group)

	N	M	SD	T	df	p	Cohen's <i>d</i>
Pre-test	60	2.39	.765	-9.298	59	.000*	0.75
Post-test	60	3.05	.986				

* $p < .05$

4.3.1.4 Comparison of pre-test and post-test scores of the experimental group in terms of their speaking skills. In order to explore whether there is a statistically significant difference between experimental group students' pre and post speaking scores after receiving ICT-Assisted PBL instruction or not, the paired samples t-test was conducted. Based on the results of the conducted paired samples t-test (Table 13), the differences between pre and post- tests were statistically significant in terms of experimental group students' level of speaking skills ($t(59) = -22.111$, $p < .05$; Cohen's $d = 2.68$). The results reported that the researcher rejected the null hypothesis and there

was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 2.68$) showed that the ICT-Assisted PBL instruction had a huge effect on students' level of speaking skills for the experimental group.

Table 13

Paired Samples T-test Statistics of Speaking Skills (Experimental Group)

	N	M	SD	T	df	p	Cohen's d
Pre-test	60	2.39	.814	-22.111	59	.000*	2.68
Post-test	60	4.28	.585				

* $p < .05$

In conclusion, the results obtained from the speaking test revealed that before the implementation, there was no statistically significant difference between control and experimental groups ($t(118) = .000$, $p > .05$). Following two different ways of instructions, both experimental and control groups had gains in terms of speaking skills. The research revealed that a statistically significant difference between control and experimental group students in terms of speaking skills ($t(118) = -8.276$, $p < .05$, Cohen's $d = 1.52$). Accordingly, the ICT-Assisted PBL instruction resulted in a huge effect in the speaking skills of the experimental group (Cohen's d : 1.52). Also, within the experimental group, the students' scores showed both statistical and practical significance in terms of the difference between pre and post scores ($t(59) = -22.111$, $p < .05$; Cohen's $d = 2.68$), which resulted in a huge effect on their speaking skills. On the other hand, the traditional way of teaching also resulted in a large effect (Cohen's d : 0.75) on the development of the students' speaking skills.

4.3.2 Effects on writing skills. The problem solution essays were evaluated by means of B1 Level Writing Assessment Rubric (Appendix H) created by Cambridge English Language Assessment in terms of content, communicative achievement, organisation, and language. The items which indicates the highest score mean that

- The student uses the conventions of the communicative task to hold the target reader's attention and communicate straightforward ideas;
- Text is generally well-organised and coherent, the student uses a variety of linking words and cohesive devices;

- The student uses a range of everyday vocabulary appropriately, with occasional inappropriate use of less common lexis;
- The student uses a range of simple and some complex grammatical forms with a good degree of control;
- Errors do not impede communication.

4.3.2.1 Comparison of pre-test scores of the control and experimental groups in germs of their writing skills. In order to explore whether there is a statistically significant difference between control and experimental group students in terms of pre-writing scores before receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-test was conducted. According to the results of the independent samples t-test (Table 14), the differences between both groups were not statistically significant in terms of students' level of writing skills ($t(118) = .052$, $p > .05$). The obtained findings indicated that there was no statistically significant difference between both groups in terms of their writing skills before the implementation.

Table 14

Independent Samples T-test Statistics of Pre-Writing Skills (Experimental & Control Group)

	N	M	SD	T	Df	p
Pre-Writing_ Con	60	2.61	.926	.052	118	.959
Pre-Writing_ Exp	60	2.60	.843			

* $p < .0$

4.3.2.2 Comparison of post-test scores of the control and experimental groups in terms of their writing skills. In order to explore whether there was a statistically significant difference between control and experimental group students in terms of post-writing scores after receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-test was conducted. Based on the results of the independent samples t-test (Table 15), the differences between both groups were statistically significant in terms of students' level of writing skills ($t(118) = -8.683$, $p < .05$, Cohen's $d = 1.6$). The obtained findings indicated that the researcher rejected the null

hypothesis and there was statistically significant difference between the means of both groups in terms of their post writing levels. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.6$) showed that the ICT-Assisted PBL had a huge effect on students' level of writing skills for the experimental group compared to the control group who followed traditional way of instruction.

Table 15

Independent Samples T-test Statistics of Post-Writing Skills (Experimental & Control Group)

	N	M	SD	T	df	p	Cohen's d
Post-Writing_Con	60	3.32	.986	-8.683	118	.000*	1.6
Post-Writing_Exp	60	4.35	.585				

* $p < .05$

4.3.2.3 Comparison of pre-test and post-test scores of the control group in terms of their writing skills. In order to explore whether there was a statistically significant difference between control group students' pre and post writing scores after receiving traditional instruction or not, the paired samples t-test was conducted. According to the results of the paired samples t-test (Table 16), the differences between pre and post- tests were statistically significant in terms of students' level of writing skills ($t(59) = -8.956$, $p < .05$; Cohen's $d = 0.85$). Accordingly, there was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 0.85$) showed that the traditional instruction had a large effect on students' level of writing skills for the control group.

Table 16

Paired Samples T-test Statistics of Writing Skills (Control Group)

	N	M	SD	T	df	p	Cohen's d
Pre-test	60	2.61	.926	-8.956	59	.000*	0.85
Post-test	60	3.32	.753				

*p<.05

4.3.2.4 Comparison of pre-test and post-test scores of the experimental group in terms of their writing skills. In order to explore whether there was a statistically significant difference between experimental group students' pre and post writing scores after receiving ICT-Assisted PBL or not, the paired samples t-test was conducted. Based on the results of the paired samples t-test (Table 17), the differences between pre and post- tests were statistically significant in terms of students' level of writing skills ($t(59) = -18.626$, $p < .05$; Cohen's $d = 2.51$). The results showed that the null hypothesis was rejected and there was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 2.51$) showed that the ICT-Assisted PBL had a huge effect on students' level of writing skills for the experimental group.

Table 17

Paired Samples T-test Statistics of Speaking Skills (Experimental Group)

	N	M	SD	T	df	p	Cohen's d
Pre-test	60	2.60	.842	-18.626	59	.000*	2.51
Post-test	60	4.35	.531				

*p<.05

In conclusion, the results obtained from the writing test revealed that before the implementation, there was no statistically significant difference between control and experimental groups ($t(118) = .052$, $p > .05$). Following two different ways of instructions, both experimental and control groups had gains in terms of writing skills. The treatment resulted in a statistically significant difference between control and experimental group students in terms of writing skills ($t(118) = -8.683$, $p < .05$, Cohen's $d = 1.6$). Accordingly, the ICT-Assisted PBL instruction resulted in a huge effect in the speaking skills of the experimental group (Cohen's $d: 1.6$). Also, within the experimental group, the students' scores showed both statistical and practical significance in terms of the difference between pre and post scores ($t(59) = -18.626$, $p < .05$; Cohen's $d = 2.51$), which resulted in a huge effect on their writing skills. On the other hand, the traditional way of teaching also resulted in a large effect (Cohen's d :

0.85) on the development of the students' writing skills.

4.4 Findings for Research Question 3

The third research question focused on examining whether there is a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their perceived levels of L2 speaking and writing self-efficacies. In that sense, Self-Efficacy Scale for English (Üstünlüoğlu, Bümen, & Öğretmen, 2018) was administered to both experimental and control group students at the beginning and at the end of the term. Their scores gained by means of rubrics were analyzed by means of both independent samples t-tests and paired samples t-tests respectively. In addition, to find out student' perceptions on each item, descriptive statistics were applied to the data.

4.4.1 Comparison of pre-test scores of control and experimental groups in terms of their perceived levels of L2 speaking and writing self-efficacies. In order to explore whether there is a statistically significant difference between control and experimental group students in terms of their perceived levels of L2 speaking and writing self-efficacies before receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-tests was conducted. Based on the results of the independent samples t-test (Table 18), at the beginning of the research, the differences between both groups were not statistically significant ($t(118) = .593$, $p > .05$). Accordingly, the findings indicated that there was no statistically significant difference between both groups' scores in terms of their L2 self-efficacy and its sub-scale scores before the implementation.

Table 18

Independent Samples T-test Statistics of Pre- Self-efficacy and Its Sub-Scale Scores (Experimental & Control Group)

Variable	Group	N	M	SD	T	df	p
L2 Self-Efficacy	Control	60	38.1	6.719	.593	118	.554
	Experimental	60	37.41	5.878			
L2 Speaking	Control	60	13.617	3.319	1.122	118	.264

	Experimental	60	12.967	3.019			
Writing	Control	60	24.483	4.143	.043	118	.966
	Experimental	60	24.450	4.307			

*p<.05

4.4.2 Comparison of post-test scores of the control and experimental groups in terms of their perceived levels of L2 speaking and writing self-efficacies. In order to explore whether there is a statistically significant difference between control and experimental group students in terms of their perceived levels of L2 speaking and writing self-efficacies after receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-tests was conducted. Based on the results of the independent samples t-test (Table 19), at the end of the research, the differences between both groups were statistically significant in terms of students' level of L2 self-efficacy ($t(118) = -2.768$, $p < .05$, Cohen's $d = 0.51$) and its sub-scales (speaking; [$t(118) = -3.157$, $p < .05$, Cohen's $d = 0.58$] and writing [$t(118) = -2.205$, $p < .05$, Cohen's $d = 0.41$]). Grounded on the results, the findings indicated that there was statistically significant difference between both groups' scores in terms of their self-efficacy and its sub-scales after the implementation. As for practical significance, the obtained Cohen's d (Cohen's $d = 0.51$) for the self-efficacy scores showed that the ICT-Assisted PBL instruction had a medium effect on students' level of self-efficacy for the experimental group compared to the control group.

Table 19

Independent Samples T-test Statistics of Post-Self-Efficacy and Its Sub-Scale Scores (Experimental & Control Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's d
L2 Self-Efficacy	Control	60	43.73	10.453	-	118	.007	0.51
	Experimental	60	48.93	10.121	2.768			
Speaking	Control	60	15.333	4.406	-	118	.002	0.58
	Experimental	60	17.933	4.613	3.157			

Writing	Control	60	28.40	6.502	-	118	.029	0.41
	Experimental	60	31.00	6.412	2.205			

*p<.05

As for the sub-scales of L2 self-efficacy scale, for speaking, the implementation resulted in a statistically significant difference between both groups with a medium effect ($t(118) = -3.157$, $p < .05$, Cohen's $d = 0.58$). On the other hand, for the writing, the findings showed that the ICT-Assisted PBL had a medium effect on students' L2 self-efficacy levels in writing ($t(118) = -2.205$, $p < .05$, Cohen's $d = 0.41$) by creating a statistically significant difference between control and experimental groups.

4.4.3 Comparison of pre and post-test scores of the control group in terms of their perceived levels of L2 speaking and writing self-efficacies. In order to explore whether there is a statistically significant difference between control group students in terms of their perceived levels of L2 speaking and writing self-efficacies after receiving traditional instruction, a paired samples t-tests was conducted. According to the results (Table 20), at the end of the research, the differences between pre and post- test scores were statistically significant in terms of students' level of L2 self-efficacy ($t(59) = -4.576$, $p < .05$, Cohen's $d = 1.26$) and its sub-scales (speaking; [$t(59) = -3.128$, $p < .05$, Cohen's $d = 0.58$] and writing [$t(59) = -5.194$, $p < .05$, Cohen's $d = 0.72$]). Grounded on the results, the findings indicated that there was statistically significant difference between control group's scores in terms of their L2 self-efficacy and its sub-scales. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.26$) for the self-efficacy scores showed that the traditional way of instruction had a very large effect on students' level of self-efficacy for the control group.

Table 20

Paired Samples T-test Statistics of Pre and Post L2 Self-Efficacy and Its Sub-Scale Scores (Control Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's d
L2 Self-Efficacy	Pre	60	38.10	6.719	-	59	.000	1.26
	Post	60	43.73	10.454	4.576			
Speaking	Pre	60	13.62	3.319	-	59	.003	0.44
	Post	60	15.33	4.406	3.128			
Writing	Pre	60	24.48	4.143	-	59	.000	0.72
	Post	60	28.40	6.502	5.194			

*p<.05

As for the sub-scales of L2 self-efficacy scale, for speaking, the traditional instruction resulted in a statistically significant difference in control group with a medium effect ($t(118) = -3.128$, $p < .05$, Cohen's $d = 0.44$). On the other hand, for the writing, the findings showed that the traditional instruction had a medium effect on students' L2 self-efficacy levels in writing by creating a statistically significant difference between their pre and post scores ($t(59) = -5.194$, $p < .05$, Cohen's $d = 0.72$).

4.4.4 Comparison of pre and post-test scores of the experimental group in terms of their perceived levels of L2 speaking and writing self-efficacies. In order to explore whether there is a statistically significant difference between experimental group students in terms of their perceived levels of L2 speaking and writing self-efficacies after receiving ICT-Assisted PBL instruction, a paired samples t-tests was conducted. Table 21 shows that at the end of the research, the differences between pre and post- test scores were statistically significant in terms of students' level of L2 self-efficacy ($t(59) = -7.273$, $p < .05$, Cohen's $d = 1.4$) and its sub-scales (speaking; [$t(59) = -6.734$, $p < .05$, Cohen's $d = 1.28$] and writing [$t(59) = -6.823$, $p < .05$, Cohen's $d = 1.21$]). The findings indicated that there was statistically significant difference between experimental group's scores in terms of their L2 self-efficacy and its sub-scales. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.4$) for the self-efficacy scores showed that the ICT-Assisted PBL had a very large effect on students' level of self-efficacy for the experimental group.

Table 21

Paired Samples T-test Statistics of Pre and Post Self-Efficacy and Its Sub-Scale Scores (Experimental Group)

Variable	Group	N	M	SD	t	df	p	Cohen's <i>d</i>
L2 Self-Efficacy	Pre	60	37.42	5.878	-	59	.000	1.4
	Post	60	48.93	10.121	7.273			
Speaking	Pre	60	12.97	3.019	-	59	.000	1.28
	Post	60	17.93	4.613	6.734			
Writing	Pre	60	24.45	4.307	-	59	.000	1.21
	Post	60	31.00	6.412	6.823			

*p<.05

As for the sub-scales of L2 self-efficacy scale, for speaking, the ICT-Assisted PBL instruction resulted in a statistically significant difference in experimental group with a very large effect ($t(118) = -6.734, p < .05$, Cohen's $d = 1.28$). On the other hand, for the writing, the findings showed that the ICT-Assisted PBL instruction also had a very large effect on students' L2 self-efficacy levels in writing by creating a statistically significant difference between their pre and post scores ($t(59) = -6.823, p < .05$, Cohen's $d = 1.21$).

To find out student' perceptions on each item, descriptive statistics were applied to the data. Table 22 illustrates the mean value of L2 writing and speaking self-efficacy. In the table, higher mean score shows more favorable perception toward the particular aspect of L2 self-efficacy beliefs. As indicated in the following table, item 7 which shows students paraphrasing ability has the highest gain score in terms of pre ($M=1.80$) and post test ($M=2.85$) comparison.

Table 22

Mean Comparisons of Pre and Post-test Scores in terms of L2 Writing Self-Efficacy

Statements	Pre –test		Post-test	
	M	SD	M	SD
1. I can write a good paragraph or essay.	2.33	.986	3.27	1.071
2. I can use grammatical rules correctly when writing a paragraph or essay in English.	2.08	.766	2.92	1.013
3. I can use punctuation marks correctly when writing a text in English.	2.53	1.112	3.05	1.096
4. I can express my thoughts fully and clearly when writing a text in English.	2.03	.688	2.97	.956
5. When I can't write something in English, I try to solve the problem instead of giving up.	3.13	1.016	3.48	1.033
6. I can emphasize important points when writing in English.	2.15	.709	2.93	.861
7. I can rewrite an English text with my own phrases.	1.80	.755	2.85	1.071
8. I can express myself in written English in daily life (curriculum vitae, application form, letter of complaint, etc.)	2.10	.817	2.90	.858
9. I can realize my mistakes after writing	2.18	.725	2.93	.936

anything in English.

10. I need help doing the activities given about writing in English. 4.10 .877 3.70 .979

In terms of perceived level of L2 speaking self-efficacy, as indicated in table 20, item 16 which shows students English speaking fluency has the highest gain score in terms of pre ($M=1.78$) and post test ($M=2.65$) comparison.

Table 23

Mean Comparisons of Pre and Post-test Scores in terms of L2 Speaking Self-Efficacy

Statements	Pre-Test		Post-test	
	M	SD	M	SD
11. I can meet my daily needs by using English. (Imagine that you are abroad, finding directions, shopping, etc.)	2.58	.850	3.45	.946
12. I can express myself in English in an interview. (University admission, job application, etc.)	1.77	.699	2.95	1.096
13. I can speak English formally or informally, depending on the purpose and situation.	1.85	.755	2.80	1.038
14. I can answer questions asked in English.	2.40	.741	2.90	.838
15. I can express my thoughts in other ways when the other person does not understand me.	2.58	.996	3.18	1.097
16. I can speak English in a way that a native speaker can understand.	1.78	.783	2.65	1.147

In summary as illustrated in table 23, in terms of students' perceptions on their L2 writing self-efficacy, their paraphrasing ability has been developed. Regarding their speaking self-efficacy, their speaking English in a way that a native speaker can understand has been improved as these items have the highest gain scores.

In conclusion, the results obtained from the L2 self-efficacy scale revealed that before the implementation, there was no statistically significant difference between control and experimental groups ($t(118)= .593$, $p>.05$) in terms of their perceived levels of L2 speaking and writing self-efficacies. Following two different ways of instructions, both experimental and control groups had gains in terms of their

perceived levels of L2 speaking and writing self-efficacies. The findings indicated a statistically significant difference between control and experimental group students ($t(118) = -2.768$, $p < .05$, Cohen's $d = 0.51$) and its sub-scales (speaking; [$t(118) = -3.157$, $p < .05$, Cohen's $d = 0.58$] and writing [$t(118) = -2.205$, $p < .05$, Cohen's $d = 0.41$]), which resulted in a medium effect on the L2 self-efficacy and its sub-scales respectively. Also, within the experimental group, the students' pre and post scores showed both statistical and practical significance in terms of their level of L2 self-efficacy ($t(59) = -7.273$, $p < .05$, Cohen's $d = 1.4$) and its sub-scales (speaking; [$t(59) = -6.734$, $p < .05$, Cohen's $d = 1.28$] and writing [$t(59) = -6.823$, $p < .05$, Cohen's $d = 1.21$]), which created a very large effect as practical significance. On the other hand, the traditional way of teaching also resulted in a very large effect on control group's L2 self-efficacies (Cohen's $d = 1.26$) and a medium effect (Cohen's $d = 0.44$; 0.72) for its subscales- speaking and writing, respectively.

4.5 Findings for Research Question 4

The fourth research question was addressed to find out whether there is a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their self-perceived autonomy levels. In line with this aim, the perceived autonomy levels of two group of students were compared by means of the Autonomous Learning Scale (Arslan & Yurdakul, 2015) administered at the beginning and at the end of the term. The data were analyzed by means of both independent samples t-tests and paired samples t-tests respectively. In addition, to find out student' perceptions on each item, descriptive statistics were applied to the data.

4.5.1 Comparison of pre-test scores of control and experimental groups in terms of their self-perceived autonomy levels. In order to explore whether there is a statistically significant difference between control and experimental group students' pre-scores in terms of self-perceived autonomy and its sub-scales Independence of Learning (IL) and Study Habits (SH) before receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-test was conducted for the Autonomous Learning Scale (ALS). Based on the results of the independent samples

t-test (Table 24), at the beginning of the research, the differences between both groups were not statistically significant in terms of students' level of self-perceived autonomy levels ($t(118) = 1.797, p > .05$) and its sub-scales. Accordingly, the findings indicated that there was no statistically significant difference between both groups' scores in terms of their self-perceived autonomy levels and its sub-dimensions before the implementation.

Table 24

Independent Samples T-test Statistics of Pre- Self-Perceived Autonomy Levels and Its Sub-Scale Scores (Experimental & Control Group)

Variable	Group	N	M	SD	T	df	p
ALS	Control	60	42.62	5.005	1.797	118	.075
	Experimental	60	41.15	3.861			
IL	Control	60	25.93	2.926	1.097	118	.275
	Experimental	60	25.23	2.902			
SH	Control	60	16.80	3.256	1.660	118	.100
	Experimental	60	15.92	2.526			

* $p < .05$

4.5.2 Comparison of post-test scores of control and experimental groups in terms of their self-perceived autonomy levels. In order to explore whether there is a statistically significant difference between control and experimental group students' post-scores in terms of self-perceived autonomy and its sub-scales after receiving either traditional or ICT-Assisted PBL instruction, an independent samples t-test was conducted. Based on the results of the independent samples t-test (Table 25), at the end of the research, the differences between both groups were statistically significant in terms of their self-perceived autonomy levels ($t(118) = -5.474, p < .05$, Cohen's $d = 1.01$) and its sub-scales (IL; [$t(118) = -4.397, p < .05$, Cohen's $d = 0.81$] and SH [$t(118) = -5.161, p < .05$, Cohen's $d = 0.95$]. Grounded on the results, the findings indicated that there was statistically significant difference between both groups' scores in terms of their self-perceived autonomy levels and its sub-dimensions after the implementation. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.01$) for the self-perceived autonomy level scores showed that the ICT-Assisted PBL instruction had a large effect on students' level of self-perceived autonomy levels for the experimental group compared to the control group who followed traditional way of instruction. Also, for the sub-dimensions of the scale, the implementation had a large effect (Cohen's $d = 0.81; 0.95$) for its subscales- IL and SH, respectively.

Table 25

Independent Samples T-test Statistics of Post- Self-Perceived Autonomy Levels and Its Sub-Scale Scores (Experimental & Control Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's
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								<i>d</i>
ALS	Control	60	43.60	6.531	-	118	.000	1.01
	Experimental	60	49.40	4.972	5.474			
IL	Control	60	26.08	3.903	-	118	.000	0.81
	Experimental	60	29.10	3.606	4.397			
SH	Control	60	17.52	3.412	-	118	.000	0.95
	Experimental	60	20.30	2.410	5.161			

*p<.05

4.5.3 Comparison of pre and post-test scores of the control group in terms of their self-perceived autonomy levels. In order to explore whether there is a statistically significant difference between control group students' pre- and post-scores in terms of their self-perceived autonomy levels and its sub-scales after the traditional instruction, a paired samples t-test was conducted. Table 26 illustrates that the differences between pre and post-test scores were not statistically significant in terms of students' level of self-perceived autonomy levels ($t(59) = -1.389$, $p > .05$) and its sub-dimensions. In accordance with the obtained statistics, the results indicated that there was no statistically significant difference between the control group's pre and post scores in terms of their self-perceived autonomy levels and its sub-dimensions after receiving traditional instruction.

Table 26

Paired Samples T-test Statistics of Pre and Post Self-Perceived Autonomy Levels and Its Sub-Scale Scores (Control Group)

Variable	Group	N	M	SD	T	df	p
ALS	Pre	60	42.62	6.719	-1.389	59	.170
	Post	60	43.60	10.454			
IL	Pre	60	25.82	2.926	-.599	59	.552
	Post	60	26.08	3.903			
SH	Pre	60	16.80	3.256	-2.005	59	.053
	Post	60	17.52	3.412			

*p<.05

4.5.4 Comparison of pre and post-test scores of the experimental group in

terms of their self-perceived autonomy levels. In order to explore whether there is a statistically significant difference between experimental group students' pre- and post-scores in terms of their self-perceived autonomy levels and its sub-scales after the ICT-Assisted PBL instruction, a paired samples t-test was conducted. Based on the results (Table 27), the differences between pre and post-test scores were statistically significant in terms of students' level of self-perceived autonomy levels ($t(59) = -9.406$, $p < .05$, Cohen's $d = 1.87$) and its sub-dimensions (IL; [$t(59) = -6.547$, $p < .05$, Cohen's $d = 1.19$] and SH [$t(59) = -9.718$, $p < .05$, Cohen's $d = 1.79$]. Accordingly, the findings indicated that there was statistically significant difference between experimental group's pre- and post-scores in terms of their self-perceived autonomy levels and its sub-dimensions after the implementation. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.87$) showed that the ICT-Assisted PBL had a huge effect on students' level of self-perceived autonomy for the experimental group.

Table 27

Paired Samples T-test Statistics of Pre and Post Self-Perceived Autonomy and Its Sub-Scale Scores (Experimental Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's d
ALS	Pre	60	41.15	3.861	-	59	.000	1.87
	Post	60	49.40	4.972	9.406			
IL	Pre	60	25.23	2.902	-	59	.000	1.19
	Post	60	29.10	3.606	6.547			
SH	Pre	60	15.92	2.526	-	59	.000	1.79
	Post	60	20.30	2.409	9.718			

* $p < .05$

As for the sub-scales of self-perceived autonomy scale, for IL, the ICT-Assisted PBL instruction resulted in a statistically significant difference in experimental group with a very large effect ($t(118) = -6.547$, $p < .05$, Cohen's $d = 1.19$). On the other hand, for SH, the findings showed that the ICT-Assisted PBL had a huge effect on students' L2 self-efficacy levels in writing by creating a statistically significant difference between their pre and post scores ($t(59) = -9.718$, $p < .05$, Cohen's $d = 1.79$).

To find out student' perceptions on each item, descriptive statistics were applied to the data. The value of mean above 3.00 indicates positive perceptions while

mean below 3.00 indicates negative perceptions. The table 28 illustrates the mean value of each sub-scale of the learner autonomy. In the table, higher mean score shows more favorable perception toward the particular aspect of learner autonomy levels. In terms of Independence of Learning, item 6 which apperiates the deadlines as a motivating factor has the highest gain score in terms of pre (M=2.98) and post test (M=4.15) comparison. Regarding Study Habits, item 11 indicating never finding excuses for not getting down to work has the highest gain score when means of pre (M=2.40) and post tests (M=4.17) are compared as illustrated in the following table.

Table 28

Mean Comparisons of Pre and Post-test Scores in terms of Learner Autonomy

Subscales Statements	Pre-Test		Post-test	
	M	SD	M	SD
<i>Independence of Learning</i>				
1. I enjoy new learning experiences.	4.02	.651	4.35	.685
2. I am open to new ways of doing familiar things.	4.00	.638	4.22	.640
3. I enjoy being set a challenge.	3.32	.911	4.38	.825
4. I enjoy finding information about new topics on my own.	4.13	.623	4.12	.666
5. Even when tasks are difficult I try to stick with them.	3.08	.907	3.87	1.186
6. I tend to be motivated to work by assessment deadlines.	2.98	1.127	4.15	1.022
7. I take responsibility for my learning experiences.	3.70	.591	4.02	.676
<i>Study Habits</i>				
8. My time management is good.	2.88	.865	3.57	.963
9. I am good at meeting deadlines.	4.00	.713	4.23	.767
10. I plan my time for study effectively.	3.03	.843	4.00	.902
11. I never find excuses for not getting down to work.	2.40	.906	4.17	.994
12. I am happy working on my own.	3.60	1.077	4.33	.774

As indicated in table 28, when self-perceived autonomy levels of were analyzed, regarding the Independence of Learning, appreciating the deadlines as a motivating factor and regarding Study Habits, never finding excuses for not getting down to work have been developed most as these items have the highest gain scores.

In conclusion, the results obtained from the self-perceived autonomy scale revealed that before the implementation, there was no statistically significant difference between control and experimental groups ($t(118) = 1.797, p > .05$). Following two different ways of instructions, both experimental and control groups had different gains in terms of their perceived levels of learner autonomy. The findings indicated a statistically significant difference between control and experimental group students ($t(118) = -5.474, p < .05$, Cohen's $d = 1.01$) and its sub-scales (IL; [$t(118) = -4.397, p < .05$, Cohen's $d = 0.81$] and SH [$t(118) = -5.161, p < .05$, Cohen's $d = 0.95$], which resulted in a large effect on the self-perceived autonomy levels and its sub-scales. Also, within the experimental group, the students' pre and post scores showed both statistical and practical significance in terms of their level of self-perceived autonomy ($t(59) = -9.406, p < .05$, Cohen's $d = 1.87$) and its sub-dimensions (IL; [$t(59) = -6.547, p < .05$, Cohen's $d = 1.19$] and SH [$t(59) = -9.718, p < .05$, Cohen's $d = 1.79$], which created a huge effect as practical significance for the whole scale and one of the sub-scales, SH. IL scores of the experimental group, on the other hand, received a very large level of effect after the implementation. On the other hand, the traditional instruction did not result in any statistical and practical significance in terms of self-perceived autonomy of the control group.

4.6 Findings for Research Question 5

The fifth research question focused on investigating whether there is a statistically significant difference in the perceptions of experimental group students regarding PBL qualifications and 4C skills after being exposed to the ICT-Assisted PBL. In line with this aim, data obtained by pre and post perception scales including Project Based Learning Qualifications Scale (Tuncer & Yılmaz, 2013) and 21st Century Skills Scale (Yılmaz & Alkış, 2019) were analyzed by means of paired sample t-tests. In addition, to find out student' perceptions on each item, descriptive statistics were applied to the data.

4.6.1 Perceptions of students regarding PBL qualifications. In order to explore whether there is a statistically significant difference in the perceptions of students regarding their PBL qualifications after being exposed to the ICT-Assisted

PBL, a paired samples t-test was conducted. Based on the results of the paired samples t-test (Table 29), the differences between pre and post-tests were statistically significant in terms of students' level of PBL self-efficacy ($t(59) = -9.606$, $p < .05$; Cohen's $d = 1.89$) and its sub-dimensions: Introduction to project qualifications (Intro to PQ), group work with project group qualifications (Group work with PQ), project self-control qualifications (Project self-control Q), conducting project qualifications (Conducting Project Q) and project finalization qualifications (Project finalization). The obtained findings indicated that the researchers rejected the null hypothesis and there was statistically significant difference between the means of the paired t-tests. As for practical significance, the obtained Cohen's d (Cohen's $d = 1.89$) showed that the ICT-Assisted PBL had a huge effect on students' level of PBL-self efficacy scores according to Cohen's criteria.

Table 29

Paired Samples T-test Statistics of Pre and Post PBL Self-efficacy and Its Sub-Scale Scores (Experimental Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's d
PBL	Pre	60	79.37	5.949	-	59	.000	1.89
Qualifications	Post	60	95.35	10.525	9.606			
Intro to PQ	Pre	60	15.15	1.665	-	59	.000	1.61
	Post	60	17.85	1.725	8.889			
Group work	Pre	60	22.75	1.892	-	59	.000	1.47
with PQ	Post	60	26.88	3.546	8.113			
Project self-	Pre	60	11.00	1.756	-	59	.001	0.72
control Q	Post	60	12.50	2.390	3.634			
Conducting	Pre	60	17.48	1.854	-	59	.000	1.43
Project Q	Post	60	21.02	2.994	6.943			
Project	Pre	60	12.98	2.251	-	59	.000	1.62
finalization	Post	60	17.10	2.839	8.400			

* $p < .05$

For the first sub-scale of PBL qualifications, which is *Introduction to project*

qualifications (Intro to PQ), the difference between pre and post-tests was statistically significant ($t(59) = -8.889$, $p < .05$; Cohen's $d = 1.61$) which refers to the huge effect of the ICT-Assisted PBL as practical significance according to Cohen's criteria.

For the second sub-scale of PBL qualifications, *group work with project group qualifications (Group work with PQ)*, the difference between pre and post-scores was statistically significant ($t(59) = -8.113$, $p < .05$; Cohen's $d = 1.47$), which resulted in a huge effect of the ICT-Assisted PBL as practical significance.

The results of the paired samples t-test also reported the differences between pre and post-tests in terms of the sub-scale *project self-control qualifications (Project self-control Q)* ($t(59) = -3.634$, $p < .05$; Cohen's $d = 0.72$). For this sub-scale, the obtained Cohen's d (Cohen's $d = 0.72$) indicated a medium effect of the applied instruction.

The differences between pre and post scores of the experimental group in terms of the sub-scale *conducting project qualifications (Conducting Project Q)* were also statistically significant ($t(59) = -6.943$, $p < .05$; Cohen's $d = 1.43$), which resulted in a very large effect as practical significance.

As for last sub-scale of the PBL qualifications, *Project Finalization*, the difference between pre and post-tests was also statistically significant ($t(59) = -8.400$, $p < .05$; Cohen's $d = 1.62$) which refers to the huge effect of the ICT-Assisted PBL instruction as practical significance according to Cohen's criteria.

To find out student' perceptions on each item, descriptive statistics were applied to the data. The value of mean above 3.00 indicates positive perceptions while mean below 3.00 indicates negative perceptions. Table 30 illustrates the mean value of each sub-scale of the PBL qualifications. In the table, higher mean score shows more favorable perception toward the particular aspect PBL qualifications. In terms of Introduction to Project Qualifications, item 3 referring to doing the literature review for project work has the highest gain score when the means of pre ($M = 3.40$) and post (4.23) tests were compared. In terms of Group Work with Project Group Qualifications, item 8, creating a discussion environment about the project topic, has the highest gain score when the means of pre ($M = 3.47$) and post (4.42) tests were

compared. In terms of Project Self-Control Qualifications, item 13, using time wisely, has the highest gain score when the means of pre ($M=3.28$) and post (4.07) tests were compared. In terms of Conducting Project Qualifications, item 17, synthesizing the information obtained from the project work, with the means of pre ($M=3.53$) and post (4.33) tests and item 18, working for a long time without worrying about solving the problem, with the means of pre ($M=2.88$) and post ($M=3.68$) tests have the highest gain scores when the pre and post tests were compared. In terms of Finalizing Project Qualifications, item 20 referring to the presentation of the project work has the highest gain score when the means of pre ($M=2.92$) and post (4.30) tests were compared.

Table 30

Subscales Statement	Pre-Test		Post-test	
	M	SD	M	SD
<i>Intro to Project Qualifications</i>				
1. I can get information for project work.	4.03	.450	4.60	.558
2. I can work by myself.	4.00	.844	4.62	.585
3. I can do a literature review for project work.	3.40	.588	4.23	.699
4. I can choose appropriate project topics.	3.72	.715	4.40	.669
<i>Group Work with Project Group Qualifications</i>				
5. I can work with a project group.	3.95	.594	4.30	.926
6. I can guide the project group mates.	3.68	.833	4.43	.831
7. I can take an active role in the project subject.	3.80	.684	4.60	.643
8. I can create a discussion environment about the project topic.	3.47	.724	4.42	.696
9. I can distribute the work of the project work.	3.63	.663	4.52	.748
10. I can communicate with my project group friends.	4.22	.454	4.62	.715
<i>Project Self-Control Qualifications</i>				
11. I can tolerate criticism of your work.	4.20	.514	4.52	.748
12. I can work patiently.	3.52	1.127	3.92	1.154
13. I can use time wisely.	3.28	.804	4.07	1.039

Conducting Project Qualifications

14. I can recognize dilemmas among the resources I scan.	3.68	.748	4.28	.691
15. I can analyze the information obtained through the project work.	3.75	.541	4.40	.616
16. I can develop appropriate strategies while trying to solve the problem situation.	3.63	.551	4.32	.701
17. I can synthesize the information obtained from the project work.	3.53	.536	4.33	.655
18. I can work for a long time without worrying about solving the problem.	2.88	.846	3.68	1.049

Finalizing Project Qualifications

19. I can evaluate the work of my project group and other groups.	3.62	.640	4.38	.715
20. I can present project work.	2.92	.926	4.30	.926
21. I can report project work.	3.22	.804	4.20	.953
22. I can publish project studies.	3.23	.851	4.22	.865

As indicated in table 30, regarding students' perceived levels of PBL qualifications, doing the literature review for project work, creating a discussion environment about the project topic, using time wisely, synthesizing the information obtained from the project work, working for a long time without worrying about solving the problem, the presentation of the project work have been developed most according to the highest gain scores.

To conclude, the findings of the research revealed that ICT-Assisted PBL instruction resulted in statistically significant differences in participants' scores in terms of their PBL qualifications and its sub-scale levels in all dimensions (Intro to PQ, Group work with PQ, Project self-control Q, Conducting Project Q and Project Finalization). Additionally, for the practical significance, in all sub-scales of the PBL self-efficacy scale, there were different levels of ICT Assisted PBL instruction's effect as reported with the Cohen's *ds* (Intro to PQ, 1.61, huge; Group work with PQ, 1.47, huge; Project self-control Q, 0.72, medium; Conducting Project Q, 1.43, very large; Project Finalization, 1.62, huge). However, when the obtained Cohen's *ds* are

compared, it is obvious that the effect of the treatment on each sub-scale is different. While the highest number of the reported effect of the ICT- Assisted PBL instruction is on the scale *Intro to PQ*, the lowest one is on *Project self-control Q*.

4.6.2 Perceptions of students regarding 4C skills. In order to explore whether there is a statistically significant difference in the perceptions of students regarding their 4C skills after being exposed to the ICT-Assisted PBL, a paired samples t-test was conducted. Table 31 shows the statistically significant differences between pre and post-tests in terms of students' level of 4C skills ($t(59) = -5.072$, $p < .05$; Cohen's $d = 0.75$) and its sub-dimensions. As for practical significance, the obtained Cohen's d (Cohen's $d = 0.75$) showed that the ICT-Assisted PBL had a large effect on students' level of 4C skills scores according to Cohen's criteria.

Table 31

Paired Samples T-test Statistics of Pre and Post 4C skills and Its Sub-Scale Scores (Experimental Group)

Variable	Group	N	M	SD	T	Df	p	Cohen's d
4C	Pre	60	67.80	6.194	-	59	.000	0.75
	Post	60	72.68	6.925	5.072			
Creativity	Pre	60	13.87	2.507	-	59	.000	0.98
	Post	60	16.08	2.036	7.068			
Critical Thinking	Pre	60	18.12	2.688	-	59	.004	0.46
	Post	60	19.40	2.889	3.018			
Communication	Pre	60	24.60	2.981	-	59	.029	0.28
	Post	60	25.45	3.050	2.240			
Collaboration	Pre	60	11.21	1.786	-	59	.049	0.27
	Post	60	12.75	2.160	1.942			

* $p < .05$

For the first sub-scale of 4C skills, which is *Creativity*, the difference between pre and post-tests was statistically significant ($t(59) = -7.068$, $p < .05$; Cohen's $d = 0.98$) which refers to the large effect of the ICT-Assisted PBL as practical significance

according to Cohen's criteria.

For the second sub-scale of 4C skills, *Critical Thinking*, the difference between pre and post-scores was statistically significant ($t(59) = -3.018$, $p < .05$; Cohen's $d = 0.46$), which resulted in a medium effect of the ICT-Assisted PBL as practical significance.

The results of the paired samples t-test also reported the differences between pre and post-tests in terms of the sub-scale *Communication* ($t(59) = -2.240$, $p < .05$; Cohen's $d = 0.28$). For this sub-scale, the obtained Cohen's d (Cohen's $d = 0.28$) indicated a small effect of the applied instruction.

As for last sub-scale of the 4C Skills scale, *Collaboration*, the difference between pre and post-tests was also statistically significant ($t(59) = -1.942$, $p < .05$; Cohen's $d = 0.27$) which refers to a small effect of the ICT-Assisted PBL instruction as practical significance according to Cohen's criteria.

To find out student's perceptions on each item, descriptive statistics were applied to the data. The value of mean above 3.00 indicates positive perceptions while mean below 3.00 indicates negative perceptions. Table 32 illustrates the mean value of each sub-scale of the 21st century skills. In the table, higher mean score shows more favorable perception toward the particular aspect of 21st century skills. In terms of creativity, item four, trying to do different things beyond the known ones, has the highest gain score when pre ($M=3.25$) and post tests ($M=3.92$) were compared. In terms of critical thinking, item 5, struggling until finding a way to solve problems and item 6, planning and putting into practice the solutions to problems, have the hishest gain scores ($M=0.40$). In terms of communication, item 11 referring to the ability to empathizing, has the highest gain scores when pre ($M=4.13$) and post ($M=4.40$) tests were compared. Lastly, for collaboration item 17, getting together with friends for a common purpose, has the highest mean score when the pre and post tests were compared.

Table 32

Mean Comparisons of Pre and Post-test Scores of 21st Century Skills

Subscales Statements	Pre-Test		Post-test	
	M	SD	M	SD
<i>Creativity</i>				
1. I can develop some new things using my imagination.	3.57	.767	4.13	.623
2. I can develop suitable methods for myself while performing a job.	3.77	.722	4.25	.571
3. I have no difficulty in generating ideas while conveying my thoughts.	3.43	.831	3.78	.846
4. I try to do different things beyond the known ones.	3.25	.914	3.92	.766
<i>Critical Thinking</i>				
5. I struggle until I find a way to solve my problems.	3.65	.799	4.05	.769
6. I plan and put into practice the solutions to my problems.	3.45	.852	3.85	.820
7. Before I do a job, I think about everything related to that job.	3.70	.869	3.65	.936
8. When making a decision, I act after collecting the necessary information.	3.73	.821	4.00	.638
9. When evaluating an event or situation, I evaluate all alternatives that will lead to a result.	3.50	.770	3.85	.820
<i>Communication</i>				
10. I provide feedback by listening to others.	4.07	.686	4.23	.739
11. I can empathize.	4.13	.853	4.40	.785
12. I listen trying to understand the other person.	4.28	.640	4.43	.673
13. I can work harmoniously with people.	3.93	.821	4.00	.974
14. I listen to people carefully.	4.12	.613	4.22	.555
15. I think about what the other person conveys to me.	4.00	.582	4.18	.596
<i>Collaboration</i>				
16. I benefit from the knowledge and experience of others.	4.00	.664	4.20	.659
17. I get together with my friends for a common purpose.	3.83	.691	4.08	.907
18. I believe that by working together, learning will be maximized.	3.37	1.008	3.47	1.267

As shown in table 32, concerning students' perceptions of 4C, trying to do different things beyond the known ones, struggling until finding a way to solve problems, planning and putting into practice the solutions to problems, empathizing, and getting together with friends for a common purpose, have been developed most as shown in the highest gain scores.

In conclusion, the findings of the research revealed that ICT-Assisted PBL instruction resulted in statistically significant differences in the participants' perceived self-efficacy levels of 4Cs and its sub-scales in all dimensions (critical thinking, collaboration, creativity, communication) after being exposed to the ICT-Assisted PBL. Additionally, for the practical significance, in all dimensions of the 4C skills, there were different levels of ICT Assisted PBL instruction's effect as reported with the Cohen's *ds* (Creativity, 0.98, large; Critical Thinking, 0.46, medium; Communication, 0.28, small; Collaboration, 0.27, small). However, when the obtained Cohen's *ds* are compared, it is obvious that the effect of the treatment on each sub-dimension is different. While the highest number of the reported effect of the ICT-Assisted PBL instruction is on creativity skill, the lowest one is on collaboration.

4.7 Findings for Research Question 6

The sixth research question aimed to investigate the students' opinions about the ICT-Assisted PB instruction. To reach this aim, written reflections of 15 students obtained during the implementation process, specifically at the end of the first and third project delivery was analyzed by means of Content Analysis. In line with this, pre and post semi-structured interviews conducted with the same 15 students to determine students' views on ICT-Assisted PBL were also analyzed by means of Content Analysis.

4.7.1 Findings on pre and post semi-structured interviews. Pre and post semi-structured interviews were conducted with 15 students to investigate students' views on ICT-Assisted PBL and analyzed by means of Content Analysis. In this regard, students' background on PBL, definition of PBL, background on SDGs in terms of raising awareness, collaboration with group members during PBL process, ICT use and integration of ICT into projects were presented via comparing pre and post interviews of the students.

4.7.1.1 Background on PBL (pre interviews). When students were asked whether they had ever participated in PBL beforehand, only one of 15 students stated that he worked a lot software development projects within class via expressing that

“For example, we developed a stock tracking system in Object Oriented Programming. Also, you can master a programming language more by developing a project with that programming language and you can move up to the next level of that language. For me one of the best ways to learn.” (Participant 1, October, 2020)

Except from him, it is found out that none of the fourteen students had ever experienced PBL before. However, they all mentioned that they were highly eager and motivated to participate in ICT-Assisted PBL class.

4.7.1.2 Definition of PBL (pre interviews). When students were asked to define PBL, majority of the students (10/15) stated that they couldn't describe PBL as they had no background knowledge and experience on it before as indicated in the following quote:

“I cannot define since I have never participated but I am willing to try and understand what it is.” (Participant 3, October, 2020)

On the other hand, the other students (5/15) were found out to be aware of what PBL is as they pointed out some elements of PBL. While three of them mentioned key features of PBL such as active participation of students within collaborative groups,

one of them emphasized permanent learning via resembling it a real world simulation and the other one who already participated in PBL focused on real life-problem solutions and putting the theory into practice as indicated in the following quotes:

“In my opinion, it’s a very effective teaching method which students can improve their cooperation skills.” (Participant 9, October, 2020)

“I think it is a teaching model that makes learning more enjoyable, permanent and easier. According to me, a kind of real world simulation.” (Participant 12, October, 2020)

“For me one of the best ways to learn is to solve real-life problems in daily life. A few students group up and they apply theoretical knowledge they learned in class. For example, you can master a programming language more by developing a project with that programming language and you can move up to the next level of that language.” (Participant 13, October, 2020)

4.7.1.3 Definition of PBL (post interviews). During the post-interviews, when students were asked about what PBL was, majority of the participants focused on essential elements and key components of PBL (11/15) while defining it such as solving a real-world problem, answering a complex question, and creating a public product or presentation, while others (4/15) also concentrated on the objectives of PBL such as developing content knowledge as well as critical thinking, collaboration, creativity, and communication skills. It was also found out from their descriptions that when students have the impression that their work was ultimately valuable as a real problem needed solving or a project that influenced others, they became more motivated to work hard as clear in the following quotes:

“It is a teaching style that handles academic social and life skills together and emphasizes the use of technology, think critically, and create solutions to public problems.” (Participant 1, January, 2020)

“I think PBL makes our learning more fun, permanent and required us to actively

engaged in each step, use our time management skills.” (Participant 6, January, 2020)

“PBL is a teaching method which students learn by applying knowledge through an engaging experience. You become open to development and innovations. Learning by doing is fun.” (Participant 12, January, 2020)

In line with these comments, it was found out students gained awareness and knowledge about PBL and they had positive attitudes towards this teaching methodology as they used metaphors such as resembling it to a master chef, special pizza, invention, rainbow, adventure, path as indicated in the following quotes.

“Similar to master chef.” (Participant 2, January, 2020)

“It is like a kind of special pizza offered from my team and me. Everyone puts little into the middle and it becomes a special, delicious food for solving the problem of hunger.” (Participant 10, January, 2020)

“PBL is the modern way of learning. You feel like an inventor while trying to create something valuable to society.” (Participant 5, January, 2020)

“It's challenging but it teaches more. It is a learning path that provides the ability to use multiple materials at the same time and take advantage of various aspects of technology.” (Participant 9, January, 2020)

“It is like a rainbow giving people different colors and perspectives. Within group work, you learn how to look various views. It means learning new information which is practical for my daily life.” (Participant 3, January, 2020)

“It is an adventure for exploring real experience challenges and problems.” (Participant 13, January, 2020)

4.7.1.4 Background knowledge on SDGs (pre interviews). When students were asked whether they had heard about UN's SDGs before or not, majority of the students (12/15) claimed that they did not have any background information and prior knowledge on these universal goals. On the other hand, only three of them mentioned that they had an idea about what these goals were. While two of them expressed positive attitudes towards the UN's SDGs and shared positive opinions towards accomplishing the goals, one of them pointed out negative ideas on the goals as shown in the following quote:

“I heard about them in high school. Unfortunately, I do not trust UNs, WHO or foundations like them. They have enough money, food and medicine for all the people but we still try solving SDG's and world problems. The rulers of the power in the world are just showing us what we want to see.” (Participant 3, October, 2020)

“I have heard before. Those goals aim to create a better world for everyone to live. It is very hard to solve every problem completely. However, all of us have to do what we can. Every man can change the world. We just need to believe this. We ruined this world step by step. We need to fix world and it depends our faith, our effort, our joy of living.” (Participant 9, October, 2020)

4.7.1.5 Background knowledge on SDGs and raising awareness (post interviews). When students were asked about their opinions on SDGs regarding post-interviews, on contrary to pre-interviews, they all stated they gained information on SDGs after the ICT-Assisted PBL process as the content of their projects depended on specifically these universal goals. In line with these, all of the fifteen students were found out to have positive attitudes towards SDGs and raise awareness on the goals. While majority of them mentioned the necessity of these goals for humanity, none of them pointed out any negative comments on reaching these goals as indicated in the following quotes:

“I learned that the 17 Global Goals aim to end poverty, protect the planet and ensure that all people enjoy peace for all over the world. Therefore, as citizens we are also responsible for taking action to achieve them both nationally and

internationally.” (Participant 5, January, 2020)

“At first, I thought that we cannot do anything to solve these big problems and I personally believed that it was the governments’ job to take precautions and save the planet. However, after I joined the project group, we tried to find out some solutions and challenge these issues. We created some useful ideas, tried to apply them. I now believe that our web-site, mobile app, and leaflets would be beneficial for the society.” (Participant 8, January, 2020)

Specifically, so as to dig into students’ awareness on each SDG after the implementation process, interviewers were asked their ideas, concerns, and their experiences on them during post-interviews. Regarding no poverty, majority of the students (almost 10 in 15) mentioned that they are concerned about world poverty. Fewer, 5 in 15 said that they were concerned about the poverty in Turkey as relevant in the following quotes:

“Due to coronavirus, every country in the world have difficulty in fighting with economic problems and their economy was badly affected. Therefore, poor countries have become much poorer and even the rich ones faced with poverty.” (Participant 1, January, 2020)

“I think poverty is one of the most common problems people face in Turkey nowadays. I see that we are getting poorer day by day because of economic crisis and pandemic.” (Participant 14, January, 2020)

When asked how they personally support people living in poverty almost half (7/15) said they contribute financially to charities or other appeals. A similar proportion (6/15) mentioned involving with campaigning groups and organize fundraising activities and volunteering with charities to directly support people living in poverty in Turkey or abroad, signing petitions for supporting socially responsible business and investment. On the other hand, two of them mentioned buying fairtrade products to help those living in poverty. On contrary to pre-interviews, none of the participants said they did not think there was anything they could do to help as indicated in the following quotes:

“I like donating to food banks and clothes banks in our district.” (Participant 2, January, 2020)

“I generally give food or water and a small bit of money to homeless people.” (Participant 10, January, 2020)

When asked how much they thought they knew about poverty overall including its causes, impacts and how to reduce it, most respondents said they felt that they knew something about poverty, including its causes, impacts and how to reduce it. 10 in 15 said that they mainly learnt about poverty in a more in-depth way through PBL activities during their time at university. 3 in 15 learnt through volunteering or other activities outside the classroom. Just over 2 in 15 were taught about poverty at primary school as shown in the following quotes:

“We were engaged in our team projects and tried to find out some authentic solutions to poverty in our local area. We created a web-site. During this process, we made a research for possible causes and effective ways to solve poverty in our city. We were feeling like governments or mayors when our ideas were taken into consideration and our charity event came true for the poor people in need.” (Participant 9, January, 2020)

Regarding zero hunger, when students were asked whether they did something personally to support sustainable food production or not, they all agreed that they paid attention to sustainable food products. In that sense, 7 in 15 say that they reduced the amount of food they waste as a way of personally supporting how we produced food in a sustainable way. Almost half (7/15) said they bought locally produced food and 2 in 15 bought Fairtrade products as shown in the following quotes:

“I believe that if we consume local products and prefer sustainable food, we have a chance to reduce poverty not only in Turkey but also in the world.” (Participant 3, January, 2020)

“As a group, we tried to create alternative sustainable food menus for restaurants.

If we have a chance put this into practice, it will work for reducing the food consumption.” (Participant 8, January, 2020)

“By means of food corners and banks we developed, poor guys will transport food to their homes.” (Participant 10, January, 2020)

On the other hand, the participating students specifically mentioned that upon developing projects on SDGs and creating their web-sites, they tried to organize fundraising activities (5/15), involved with campaigning groups, sign petitions, volunteer with charities to directly support people living in poverty in Turkey or abroad (4/15), contribute financially to charities or other appeals (4/15), buy organic food (1/15), change their diet to eat less or no meat and other animal products(1/15) as indicated in the following quote:

“Growing my own fruit and vegetables or raising my own animals for meat.” (Participant 2, January, 2020)

Most respondents said they felt that they knew something about hunger and access to food across the world, including its causes, impacts and how to reduce it. 2 in 3 (63%) said that they mainly learnt about hunger and access to food when they were taught about hunger at college. They specifically mentioned that they learnt facts and details through volunteering or other activities outside the classroom during their project development process as relevant in the following quotes:

“Zero hunger projects we designed and created taught us many realities that people met in real life.” (Participant 4, January, 2020)

“When we search for hunger in Turkey and in the world, we looked at the statistics and made use of the interesting facts to be used in our websites.” (Participant 15, January, 2020)

Regarding Quality education, when students were asked what kind of barriers to accessing learning opportunities (e.g. school, college, university, training courses)

they personally faced, it is found out that the most common barrier to accessing learning reported by respondents is a lack of money / being unable to afford it (7/15). A lack of information referring to no learning opportunities was also cited as a barrier (5/15) as well as difficulty finding time (2/15) and lack of help and assistance (1/15) as shown in the following quotes:

“Even though I have been a successful student during my academic life, if I could not get scholarship, it would be impossible for me to maintain my education.” (Participant 6, January, 2020)

“My family cannot afford anything including school fee and accommodation. Thanks to the part time job and charity things, I continue my school life.” (Participant 9, January, 2020)

“You know during pandemic, reaching to available sources and receiving online education became more difficult as we needed more assistance compared to face to face times.” (Participant 11, January, 2020)

When students were asked to think about the different ways of learning they might have experienced while they've been in education so far, projects were described as the best learning experience that they have enjoyed most (10/15) followed by lectures and seminars (3/15), problem solving activities and open discussions were also seen as valuable (2/15) as relevant in the following quotes:

“Projects helped us to apply our knowledge and skills to solve real world problems such as poverty, hunger, education, economic issues.” (Participant 1, January, 2020)

“Instead of English-only theoretical lessons, projects we developed this term made me feel totally engaged in the lesson.” (Participant 7, January, 2020)

“During our group discussion in break-out rooms and class presentations related to projects, I saw difference between the traditional way of learning and PBL.”

(Participant 12, January, 2020)

In line with this, students shared their concerns for gender equality, as they strongly believed that in the world as a whole more needs to be done to ensure men and women are equal. Almost 5 in 15 said they have been discriminated against because of their gender and have experienced discrimination as illustrated in the following quote:

“When I entered university entrance exam and passed it successfully, people in my neighborhood, some of my relatives and even my family members were opposed to my preferences to become an engineer, as they believed that some of the jobs like engineering are bound to only man and not appropriate for woman.”

(Participant 5, January, 2020)

Majority of the respondents (12/15) showed concern about unemployment with saying they were concerned about finding a job after they finish their majors as clear in the following quote:

“I believe that finding a proper job will be a problem for me as I have already known that there are lots of unemployed people graduated from this department and still trying to find out jobs. That’s why I feel helpless and hopeless at the same time.” (Participant 3, January, 2020)

Only three of them were found out to be unconcerned about finding out a proper job after they graduated from university as shown in the following quote:

“I don’t think that finding a job will be difficult for us as software engineering is one of the highly demanded job branches nowadays due to developing technologies. And you know, every field needs computer sciences for keeping up with future developments.” (Participant 11, January, 2020)

As aforementioned, 12 participants stated that they were concerned about finding a job. In line with this, it was found out that under employment was an issue with 4 out of 12 saying they were concerned about finding a job that matched the skills and

knowledge they had developed during their university life. Thinking in more detail about employment after completing their majors, respondents reported a range of other concerns, including finding a job that paid a wage that met the costs of living (3/12). Long term prospects (3/12) and fair treatment (2/12) are other key concerns amongst respondents as indicated in the following quote:

“I know that for being accepted by a well-known company, I need to be a very qualified and experienced engineer. Therefore, I am not sure whether I can fulfill the requirements for better-paid companies.” (Participant 7, January, 2020)

When it comes to their future careers, all of the respondents showed desire to work for responsible companies that contributes positively to society and the environment agreeing respectively that they should prioritise human wellbeing and social equity as relevant in the following quotes:

“Personally, working for national or international companies that pay attention to human rights and world peace is important for me.” (Participant 8, January, 2020)

“While looking for job, I will take into account lot of features such as ethical considerations and social equity.” (Participant 10, January, 2020)

4.7.1.6 Collaboration with group members (pre interviews). When students were asked whether they had worked within groups for achieving a task or project before in the pre interviews, majority of them (9/15) stated that they occasionally worked within study groups for their school assignments, specifically for writing reports in lab lessons and creating tasks in vocational courses as shown in the following quotes:

“Working in collaboration is something new for me as I used to study alone instead of working in groups or with pairs. However, we were expected to work together during some of the lessons.” (Participant 5, October, 2020)

“In general, lecturers give us choice to work with classmates and we prepare our

assignments together.” (Participant 1, October, 2020)

However, some of the students (6/15) claimed that they had never experienced working in groups for a long period of time during their academic life as indicated in the following quotes:

“This will be my first experience for collaborating with other. Because at high school, I usually studied on my own, took private courses and never worked with others.” (Participant 3, October, 2020)

“I haven’t work in collaboration with my friends before as I prefer working on my own for school subjects.” (Participant 6, October, 2020)

When students were asked how they would feel about collaborating with other group members on the same project, it was found out that majority of the students had negative attitudes towards group work (8/15) as they preferred working on their own instead of peers. While some of them justified their negative feelings, as this would be the first experience of them (3/8), others including the experienced students in group work (5/8) mentioned their concerns and hesitations for working in groups due to sharing the responsibilities and work equally, the feeling of inadequacy and stress as shown in the following quotes:

“This will be a first experience. Because I have never worked in group for creating a project before and I feel a bit stressful and nervous but very excited about collaborating with my peers.” (Participant 7, October, 2020)

“I will feel stressful as I am just afraid of failing or inadequate.” (Participant 11, October, 2020)

“It disturbs me because everyone in the group have to do something about project but doing the distribution of tasks is too hard.” (Participant 12, October, 2020)

On the other hand, some of the students (7/15) had positive attitudes on

collaborating with group members as they mentioned that it would be an advantage and better way of studying compared to working individually as shown in the following quote:

“I think we learn faster and better together. When we encounter a problem, we can obtain different solutions by exchanging ideas. If everyone makes own job correctly, I feel relaxed and successful.” (Participant 14, October, 2020)

4.7.1.7 Collaboration with group members (post interviews). When students were asked for their feelings on collaboration with group members, different from the pre-interviews, majority of them were found out to have positive feelings and attitudes on collaboration except from only one participant having negative comment as shown in the following quote:

“Due to selfishness of the group members and inequalities of work share, I had difficulty in working in groups. It was both time-consuming and effort wasting for me.” (Participant 1, January, 2020)

On the other hand, students who have positive attitudes towards collaborative work, made use of metaphors for describing their feelings on collaboration such as getting to the 9th floor with a lift, being a piece of an big puzzle, a CEO as shown in the following quotes:

“It feels like climbing to the 9th floor with an elevator. Different perspectives are always good. It makes me feel excited as there is a new target for us.” (Participant 9, January, 2020)

“Making projects with the group makes it much easier to exchange ideas and cooperate. I feel like I am part of something bigger like a piece of a big puzzle.” (Participant 11, January, 2020)

“It’s a good feeling to work in a group which each person has a maintained mission. We are working with my group in the project in a planned way. After deciding what to do, we complete our project by sharing tasks. I feel myself like

a CEO of a well-known company.” (Participant 8, January, 2020)

4.7.1.8 ICT use and integration of ICT into projects and tasks. Students’ opinions on ICT integration are presented in detail.

4.7.1.8.1 Use of technology and ICT tools (pre interviews). When students were asked whether they used technology and which ICT tools they used in their daily routine, pre-interviews indicated that all of the students were in favor of using ICT tools in their social and academic life. All of the students were found out to use their mobile phones and laptops effectively for communication with friends, academic stuff and reach available sources online. Specifically, majority of the students mentioned using web 2 tools in their daily lives such as social networking sites (Facebook and LinkedIn as individual profiles and lists of network connections/friends), microblogs (Twitter for sharing short pieces of digital content like text, photo, video, links, etc. in a message format), web-based office tools (Google Apps, documents, presentations, calendar, desktop office applications for sharing or collaborative creation and editing), and podcasts as indicated in the following quotes:

“I prefer using social media very often. I am into Twitter and Facebook as well as YouTube for watching educational videos.” (Participant 1, October, 2020)

“I have a laptop and a mobile phone. I use these synchronized. In addition, I am in love with Podcasts. Except that, I am watching educational videos on YouTube like Ted Talks and searching everything online. I also use technology to make contact with friends, learning, and surfing.” (Participant 12, October, 2020)

4.7.1.8.2 Use of technology and ICT tools (post interviews). Upon the post-interviews, when students were asked which ICT tools they used in general and during the term, it was found out that they made use of web 2, web 3, as well as web 4 tools thanks to ICT-assisted PBL instruction. They claimed that they were in need of lots of the ICT tools as a requirement of the PBL approach. In addition, they added that they needed to keep in touch with each other very often for creating the projects and work

collaboratively by means of making use of WhatsApp, Teams, discord, and zoom. In that sense, majority of the students mentioned using web 2 tools such as blogs (Wordpress as individual self-publishing tools for text, media and published posts), Web-site creation (Wordpress, Wix, Weebly, Blogspot, Godaddy), Wikis (MediaWiki for multi-author content creation and organization, editing), media sharing tools (YouTube and Flickr for sharing specific media types like videos and photos; and for individual self-publishing), design tools (Canva, Stencil, Snappa, DesignBold, Lucidpress for designing an online brochure/booklet/flyer or a poster); web 3 tools (Mobiroller, Appypie, Appyourself, Buildfire, Goodbarber, Flutter for mobile app development; QR code creation); and web 4 tools (Unity 3D, Arize AR App, HP Reveal App for Augmented Reality) as indicated in the following quotes:

“I use ICT tools as they improve me, allow me to research, learn or spend time efficiently. For our project, the tools we use included canva, wix, appyourself, overly. Of these, the ones I prefer to use are canva and wix.” (Participant 2, January, 2020)

“I’m using so many ICT tools for coding, photoshop programs, some sketch programs for my hobbies. I do use technology during this semester like compilers and web tools including Canva, adobe premier pro. I also often use programming languages for creating something.” (Participant 9, January, 2020)

4.7.1.8.3 Integration of ICT to school assignments (pre interviews). When participants were asked how they used technology in their school assignments, the pre-interviews revealed that students made use of technology for making an online research (8/15), preparing presentations (5/15), and writing reports (2/15) as shown in the following quotes:

“I usually use Google in my school assignments. I do research, write something on Word or Google Drive; prepare a presentation on PowerPoint etc. Also, I use Drive to hold my kinds of stuff in a file which are important for my assignments. I watch videos if I need. Google Scholar has great sources by the way.” (Participant 4, October, 2020)

“We are studying at home because of the Covid-19. And we are learning on computer. I haven’t any problem for now. I can make all things in my school assignments such as conducting research and writing reports.” (Participant 11, October, 2020)

4.7.1.8.4 Integration of ICT to school assignments (post interviews). When participants’ integration of technology in their school assignments were examined in the post-interviews, it was found out that regarding the requirements of the ICT-Assisted PBL in their General English course, they made use of technology more frequently compared to the pre-interviews. For instance, some of the students asserted that they became more engaged in technology during this term for making online research (6/15), looking into online dictionaries (3/15), collaborative text creation (2/15), communicating with each other for collaborative project work (2/15), and preparing presentations (2/15). In addition, eight of the participants pointed out the benefits of technology in this modern era as they found out the innovations and web tools as essential elements for fulfilling their majors at college. It was also found out that upon the ICT-Assisted PBL process, students became more engaged, willing and effective in technology use as relevant in their following quotes:

“For the projects of this course, I started taking Android studio lessons on udemy because the most important thing for me is to gain some life-long learning skills rather than only completing this assignment.” (Participant 1, January, 2020)

“Usually, I benefited from web tools for the projects this term. I mostly reviewed the articles online. I used Unity3D for developing AR integrated storybook and HTML&CSS&PHP programming languages for developing websites. For mobile applications, I use React-Native. It is a framework for a developing a mobile app.” (Participant 15, January, 2020)

4.7.1.8.5 Integrating technology into projects (pre interviews). When students were asked how they would feel in incorporating technology into their projects upon completing their first project, the pre-interviews indicated that majority of the students weren’t concerned about integrating technology into project creation process while

only two of them shared their concerns on including new technologies to their projects. Specifically, students who have positive feelings on using the technology for their projects asserted that technology use will make their job easier and more rigorous whilst the ones who have negative feelings on the integration of technology claimed that it would be challenging to use new tools they hadn't experienced before as shown in the following quotes:

“I think this is a "must" for PBL activities. I mean using technology, cooperating with others to make big projects that will be applicable.” (Participant 11, October, 2020)

“I think it is better when we incorporate technology in PBL as it will be practical, easy, comfortable, a bit challenging but time-saving at the same time.” (Participant 14, October, 2020)

4.7.1.8.6 Integrating technology into projects (post interviews). When students' feelings towards the integration of technology into their projects were sought, the post-interviews illustrated that majority of the students became more competent and comfortable in using the technology after ICT-Assisted PBL instruction as they had a chance to learn and apply new ICT tools. They also pointed out that technology use facilitated PBL as it provided more permanent and time-saving learning process as shown in the following quotes:

“With the technologies we integrate into our projects, I spend less time and enjoy the process. Technology is everything. So I love using it and I was very happy and comfortable using it for my homework. I feel as if I do a professional work.” (Participant 3, January, 2020)

“I felt fit for the new age and the assignment becomes practically easier than to web-tools. At the same time, technology integration into PBL makes learning more permanent, effective and qualified.” (Participant 4, January, 2020)

At the same time, some of these students also reflected positive attitudes via

using metaphors like feeling as if they were warriors, inventors, the greatest software programmers, innovator as relevant in their following quotes:

“It makes me feel like I'm changing something in the world in a good way. It's like I'm not waiting for somebody to save the world and I'm saving it as a warrior with the tools I used and the problems I solved.” (Participant 6, January, 2020)

“When I incorporate technology into projects, I think the projects become more original and much more useful. I felt innovative, self-confident and highly motivated.” (Participant 8, January, 2020)

“I feel like a great inventor when I integrate technology into my project. When I saw my ideas in 3D format via AR and practical solutions which could be used in everyday life, I believe that I became a real innovator.” (Participant 11, January, 2020)

“I feel like the world's best software programmer and it is great that I learn and apply things that will always work for me throughout my career and life.” (Participant 12, January, 2020)

Furthermore, only one of the students claimed that in spite of the challenges they had while getting used to the new ICT tools, they found technology integration to PBL as a highly effective way as indicated in the following quote:

“We, as a whole group, had difficulty in integrating AR to the brochure we created as this was the first time we ever tried it. However, the result was wonderful when we succeeded. It made us feel more knowledgeable, improved, engaged and excited at the same time.” (Participant 13, January, 2020)

4.7.1.8.7 Technology use in PBL (pre interviews). When students' technology use for PBL was examined, the pre-interviews showed that some of the students (6/15) couldn't be sure on how to integrate technology to PBL as they had no background knowledge and experiences of PBL before as relevant in the following quote:

“This will be the first time I will develop a project and integrate technology. For this reason, I don’t know how the process will be.” (Participant 2, October, 2020)

On the other hand, some of them (5/15) concentrated on the free and easy access of available sources for project development process as relevant in the following quotes:

“There have been many choices from Office programs to other web tools. We can also use technology for prepare a presentation and share with our teacher or friends.” (Participant 7, October, 2020)

“We can use technology to making some posters, doing research, and teleconferences on internet as it provides research and access to statistical information via the internet and send it to my colleagues immediately.” (Participant 14, October, 2020)

In the same vein, some of the students (4/15) pointed out that technology could be used for communicative purposes with group members as a support for collaboration and underlined the significance of integrating technology into PBL for cooperating with group members during pandemic as shown in the following quotes:

“We can make conversations on Google Meet, Discord or open Google Drive and create a folder and in that folder there can be a Google Documents where everybody in the project group can make changes and add some information at the same time.” (Participant 1, October, 2020)

“PBL often involves more than one person working on a specific project. Therefore, collaboration is important in this type of learning and communication technologies can be used to keep in touch with group members and become more organized.” (Participant 11, October, 2020)

“We can connect our group members by means of Teams, Skype, WhatsApp and

make use of free and easy way to communicate.” (Participant 8, October, 2020)

4.7.1.8.8 Technology use in PBL (post interviews). When students were asked for further examples of how technology was used for PBL; different from the pre-interviews, the post-interviews illustrated that students became aware of how to integrate technology to PBL and they felt themselves competent in using the emerging technologies for supporting and enriching their projects. In this regard, some of the students (7/15) concentrated on reaching community and actualizing the project via technology as indicated in the following quotes:

“We can do research using the technology and we can make our project real. For instance, you can make an internet blog to spread the problem solution or raise awareness about it so other people can understand it.” (Participant 3, January, 2020)

“We use technology in many areas today. I think we can get help designing projects or it can be easier to get community support for the project through technology. We can benefit from web-site tools, some apps for making posters and Adobe apps.” (Participant 4, January, 2020)

In line with these, many other students (8/15) listed different kinds of educational purposes for supporting their projects via ICT tools and emerging technologies. For instance, they focused on web 2, 3, and 4 tools for creating web-sites, mobile app development, and AR integrated brochure preparation as relevant in their following quotes:

“To do research, prepare a presentation or a report, to see previous projects on that subject, we can benefit from technology and its sources. We can make use of Wikis, blogs, social networking sites, etc.” (Participant 1, January, 2020)

“For 3D brochure, unity; for a more user-friendly interface, Flutter; for web site creation and front-end, bootstrap, jQuery technologies; for back-end, Asp.Net Core frameworks could be used and your projects will become more creative,

original and authentic thanks to them.” (Participant 9, January, 2020)

4.7.1.8.9 Technology support from others (pre interviews). When participating students were asked who could provide them with the technology support that they may need, it was found out in the pre-interviews that most of them (9/15) thought that academicians and the institution would support them for technology assistance while the others (5/15) asserted that they could individually manage the technological stuff by means of available sources in the internet as clear in the following quotes:

“Almost everyone can access to basic technology in our modern days. There are many free tools available on the internet.” (Participant 6, October, 2020)

“University can provide technology support by purchasing required licenses.” (Participant 7, October, 2020)

On the other hand, only one of the students mentioned that a peer could support him when he needs technology assistance as relevant in the following quote:

“I can ask my friends who has better knowledge; if I am still not satisfied I will search on the Internet for information.” (Participant 11, October, 2020)

4.7.1.8.10 Technology support from others (post interviews). After ICT-assisted PBL, when students were again asked who could provide them with the technology support that they need, different form the pre-interviews, it was found out that ten of them mentioned group members as the supporters except from three students claiming lecturers and two students who mentioned institutions assisting entrepreneurs as indicated in the following quotes:

“I think big companies and institutions who support entrepreneurs could help us.” (Participant 5, January, 2020)

“Our group members could provide the technology support, especially the specific tools whenever we were in need.” (Participant 9, January, 2020)

“I can ask for the lecturers for their advice and help.” (Participant 10, January,

2020)

“More knowledgeable peers are always better in sorting out our problems and assisting us in technology integrated things.” (Participant 14, January, 2020)

4.7.1.8.11 Pros and cons of ICT tools (pre interviews). When students were asked whether they found ICT tools advantageous or disadvantages, the results of the pre-interviews evidenced that all of the students except from one thought that ICT tools are advantageous via giving justifications such as providing them easy access to information (7/15) and being time-saving (6/15) as indicated in the following quotes:

“I find it advantageous. Because it provides easy access to information and communication. Also, we can find everything on the Internet easily.” (Participant 1, October, 2020)

“With pandemic all around the world, I cannot dream a world without technology and tools. Technology evolves and gets better every day and gets more and more involved in our lives. We cannot ignore this fact.” (Participant 4, October, 2020)

On the other hand, only one of the students mentioned the disadvantageous of ICT tools as indicated in the following quote:

“I think too many ICT tools made us lazy. Instead of coding our own programs, we could find out lots of available ready products offering us pre-prepared websites, apps, and designs.” (Participant 14, October, 2020)

4.7.1.8.12 Pros and cons of ICT tools (post interviews). In terms of the advantageous or disadvantages of ICT tools, similar with the pre-interviews, majority of the students (9/15) again found out ICT tools as advantageous as shown in the following quotes:

“I find it advantageous because we can easily access information, it enables

better learning and it is time-saving. For example, if you need to create a website or application there are so many things that can help you rather than coding.” (Participant 4, January, 2020)

“I think ICT tools are advantageous because it is amazing to see that your hard work actually turned into something good. It also enables rapid prototyping. As an example, a mobile application for a school assignment.” (Participant 6, January, 2020)

However, different from the pre-interviews, it was found out that there are many students (6/15) concentrated on both pros and cons of ICT tools and technology causing for being lazy, spending too much time online, information pollution as shown in the following quotes:

“It is really advantageous as long as it is used correctly, but unfortunately, it can be the killer of our most precious thing when used incorrectly. Time. We should plan our time well, neither working on the computer too much nor taking too many breaks. Balance brings perfection.” (Participant 3, January, 2020)

“It is advantageous in terms of fast access to information, but it also has a disadvantage such as information pollution because there is too much misinformation or inconsistent information.” (Participant 10, January, 2020)

4.7.1.8.13 ICT as a threat or asset for academic work (pre interviews). When students were asked whether ICT could help or hinder them while accomplishing their academic tasks and the reasons beyond their ideas were investigated, the pre-interviews showed that majority of them found out technology and ICT tools as effective aids due to easy and free access to available sources indicated in the following quote:

“For accessing information easily and faster, ICT is very helpful for me because everything is available on the internet and different information sources are free there. I can read various articles about my academic tasks.” (Participant 3, October, 2020)

On the other hand, only two students mentioned both negative and positive sides of technology and ICT tools as they stated that too much use of web tools may cause information pollution and incompetency of using them may accelerate stress in spite of their easy access and free access to all sources online as indicated in the following quotes:

“Depends on the ways of using it, it could be helping since it makes things easier to do but it may be hindering to some when the ICT broke mid-way and we have no backup to recover if you are not competent enough, it becomes very stressful. It helps me. Because I have the ability to access important information, create projects, and review the articles.” (Participant 8, October, 2020)

4.7.1.8.14 ICT as a threat or asset for academic work (post interviews). Post-interviews which concentrated on finding whether students saw ICT as a threat or asset for accomplishing their academic tasks indicated that all of the students appreciated the advantageous of technology during their project organization, development, and presentation process. Specifically, students were in favor of using Web tools effectively so as to reach available sources freely and more easily. They mentioned that within the PBL process, they had a chance to learn and apply new Web 2, 3 and 4 tools. Therefore, almost all of the participating students accepted technology as an asset rather than a threat for managing their tasks, doing their assignments, and creating their projects as relevant in their following quote:

“Of course, technology saves a lot of time. Within this term, we used many different tools like canva, Unity 3D, Flutter. They all taught me how to integrate technology into our projects and they all are beneficial for our improvement academically.” (Participant 10, January, 2020)

On the other hand, only one of the students was found out to mention that it could cause challenges because of too much information and problem of eliminating the correct, reliable and necessary information as relevant in the following quote:

“Although it is very helpful in reaching information, finding what I want to learn and generating ideas, I sometimes have difficulties due to the existing information pollution.” (Participant 9, January, 2020)

4.7.1.9 Opinions on PBL (pre interviews). When students were asked whether they found PBL advantageous or disadvantageous, it was found out in the pre-interviews that most of the students (8/15) were in favor of PBL in spite of their inexperience. The ones who mentioned solely pros of PBL pointed out the importance of collaboration, solving real life problems, active learning process, and technology integration, as relevant in the following quote:

“I find it advantageous. Because it teaches cooperation while discovering various ideas and supporting each other. For example, a person cannot solve some problems but team can. In addition, as we are at the center of the solution of the problem, this encourage us to be creative, think critically find out our own way of learning, tolerate others mindsets.” (Participant 2, October, 2020)

On the other hand, some of the students (6/15) were found out to mention both pros and cons of PBL as indicated in the following quote:

“I think both. Because it is useful and it makes learning easier but it is challenging sometimes.” (Participant 7, October, 2020)

On contrary to the positive attitudes towards PBL in general, only one of the students mentioned only disadvantages of PBL as clear in the following quote:

“So many projects and deadlines will give me anxiety so I do not think I would like it much.” (Participant 8, October, 2020)

4.7.1.10 Opinions on PBL (post interviews). When students' opinions on the advantageous or disadvantageous of PBL were examined upon fulfilling the third project, it was found out in the post-interviews that many students (7/15) saw PBL as advantageous as indicated in the following quotes:

"I find PBL advantageous. Because with PBL, we make what we learned permanent. It makes us, more productive via providing opportunities for experience." (Participant 3, January, 2020)

"I find it advantageous as it makes us work harder and allows us to learn more. We can use our skills for solving world problems. We can think broader." (Participant 7, January, 2020)

On the other hand, some of the students (7/15) were found out to focus both pros and cons of PBL as indicated in the following quotes:

"I find it advantageous in terms of learning, but it can be difficult when you have little time. I mean, it lets students learn while creating something, it gives us a chance to use our newly learned knowledge. From another perspective, requires a lot of effort and becomes pretty overwhelming. Deadlines give me anxiety and means much more stress for me." (Participant 10, January, 2020)

"I think the answer is both. The advantage is that it broadens people's horizons, we can learn a lot of new unknown information. The disadvantage is that finding solutions to some issues can be really troublesome and difficult." (Participant 5, January, 2020)

On contrary to the positive thoughts and comments towards PBL in, only one of the students mentioned disadvantage of PBL and negative ideas on it as clear in the following quote:

"I didn't like it at all because deadlines give me anxiety. Constantly trying to come up with an idea is really exhausting and we trying to get used to integrate

specific technology for a specific topic/ problem is very limiting.” (Participant 14, January, 2020)

In summary, when students’ pre and post interviews were analyzed majority of the students were found out to be inexperienced with PBL at first and haven’t been participated in PBL before except from one who participated in software development project in the previous years. Due to lack of background knowledge on PBL, majority of the students were even unable to define PBL. On the other hand, the post-interviews indicated that the participants gained awareness and knowledge on PBL, had positive attitudes towards it and focused on essential elements, key components, and steps of PBL process while describing it. In line with this, most of the students were found to have no prior knowledge on SDGs before the PBL. However, according to the results of the post-interviews, all of the students asserted to gain knowledge and awareness on the SDGs and had positive perspectives on these global goals concerning the content of their projects and reflected the necessity to be engaged with them. Regarding the collaboration with group members, the pre-interviews showed that although majority of them experienced group work in their academic life before, they still preferred to work on their own and had some negative attitudes and concerns on collaborative work. Different from the pre-interviews, majority of the students were found out to have positive feelings and attitudes on collaboration during the post-interviews. When students’ ICT and technology use were examined, it was found in the pre interviews that all of the students were in favor of engaging with them in their daily lives specifically web 2 tools such as social networking sites, microblogs, web-based office tools, and podcasts. In a similar vein, post interviews revealed that as well as web 2 tools (blogs, Wikis, media sharing tools, design tools), students benefited from web 3 (mobile app development and QR code creation tool) and 4 tools (AR integration) as a requirement of the PBL approach. In addition, so as to work collaboratively for project creation during pandemic, they actively used WhatsApp, EDMODO, Teams, discord, and zoom platforms. In terms of the integration of ICT to school assignments, the pre-interviews revealed that students made use of technology for making an online research, preparing presentations, and writing reports. On the other hand, post-interviews showed that students made use of technology more frequently as they became more engaged with technology during project development

with the intention of making online research, looking into online dictionaries, collaborative text creation, communicating with each other for collaborative project work, and preparing presentations. It was also found out that upon the ICT-Assisted PBL process, students became more engaged, willing and effective in technology use. Regarding the integration of technology into projects, the pre-interviews indicated that majority of the students weren't concerned about integrating technology into project creation process. In line with this, the post-interviews illustrated that most of the students became more competent and comfortable in using the technology after ICT-Assisted PBL instruction as they had a chance to learn and apply new ICT tools. They also pointed out that technology use facilitated PBL as it provided more permanent and time-saving learning process. When technology use in PBL was sought, different from the pre-interviews, the post-interviews illustrated that students became aware of how to integrate technology to PBL and they felt themselves competent in using the emerging technologies for supporting and enriching their projects. In terms of technology support, while pre-interviews revealed the focus on academicians, the institution, and individual solutions for technology assistance; post-interviews showed the preferences of group members as supporters in general. Regarding the Pros and cons of ICT tools, pre-interviews evidenced that all of the students except from one thought that ICT tools are advantageous via giving justifications such as providing them easy access to information and being time-saving. Similarly, post interviews showed ICT tools were advantageous. However, cons of these tools included causing for being lazy, spending too much time online, information pollution. In terms of students' perceptions of ICT for academic work, both pre and post interviews indicated that students found technology and ICT tools as effective aids due to easy and free access to available sources. Lastly, when students' opinions on PBL were analyzed, it was found out that almost all of the students appreciated PBL as an effective method fostering their productive skills as well as 4Cs and underlined that it was a beneficial, innovative and enjoyable way of learning.

4.7.2 Findings on written reflections. Written reflections of the 15 experimental group students were conducted at the end of the first and third project sessions during the implementation process with the aim of examining their opinions on ICT-Assisted PBL. In this regard, the students were expected to reflect their ideas

on pre-determined prompts (Appendix F) based on the emerging technology tools they used during project work, process of PBL, collaborative work, PBL for the development of writing, speaking, and 4C skills, awareness on SDGs and their integration into their projects so as to gain in-depth insights of the students on ICT-Assisted PBL implementation process in a more detailed way. Their written reflections were analyzed by means of Content Analysis.

4.7.2.1 ICT tools (*pre written reflections*). When students' ideas on the use of ICT tools were analyzed, it was found out that after the first project, they had a chance to make use of new web tools such as Wordpress, Wix, Blogspot, Godaddy, Figma, Weebly. As shown in the following quotes, majority of them found these tools practical, user-friendly, timesaving, and beneficial:

“The wix and mobillerapp Web tools we used in this process enabled us to easily publish the data we collected and save time with ready-made design templates, making our work easier and increasing our productivity.” (Participant 1, November, 2020)

“Web tools enable us to implement the projects in an easier and more practical way. We used Wix and Figma in our projects. Wix allowed us to easily design and publish the website through templates, without requiring any web programming knowledge without writing code. It was rich in options and templates. Adalo was also more functional than other apps.” (Participant 4, November, 2020)

Majority of the students also mentioned that these web tools made them more productive, efficient-time managers and made their learning process more active, permanent, and effective as shown in their following quotes:

“ICT tools are very useful as these help us a lot with time it was useful to use wordpress for projects and other works instead of writing codes. We used wix editor for the website, it was very practical. We could use the templates we

wanted, customize the background and graphics. The transactions we made were recorded automatically and we could undo the transactions we made.” (Participant 6, November, 2020)

“ICT tools make learning easier, make learning permanent, and that we should definitely take advantage of. I actively use Wordpress, GoDaddy, Cpanel. It is an ideal system for beginners. Perfect for us to improve ourselves.” (Participant 9, November, 2020)

In addition, some of the students asserted that they preferred to code their own web sites in spite of the advantages of already available sources on internet as these web tools provide many user-friendly visual and effective interfaces as indicated below:

“I'm in favor of writing the code myself, but if we look at the time-aesthetics, it's really nice that it provides the opportunity to produce a product that works a lot and can be produced in a week or even longer with a little research, in a shorter time.” (Participant 1, November, 2020)

4.7.2.2 ICT tools (post written reflections). When students’ opinions on ICT tools were analyzed, it was found out that they basically made use of emerging technologies and web 2, 3, and 4 tools such as Wordpress, Wix, Weebly Blogspot, Godaddy, Mobiroller, Unity 3D, UniteAR, Sketchfab, App development tools for creating a web-site, mobile app creation, and AR integrated brochure as shown in the following quotes:

“It allows us to make our projects very quickly. We save time and create original projects. We used many applications such as Wix, Flutter, Unity 3D, Vuforia, Sketchfab, etc. (Participant 2, January, 2020)

“I learned new things in Adobe Photoshop and it contributed to my logo making. At the same time, I had the opportunity to work with Unity. There is no doubt that it will contribute to my 2D game project in the future.” (Participant 12, January, 2020)

Different from the findings of the pre written reflections, post reflection papers indicated that students became more competent in using web-tools, became autonomous learners for reaching and making use of recent tools, dealing with technical stuff on their own and benefiting from available online sources more elaborately due to their beneficial, time-saving practical, functional, and user-friendly characteristics as shown in the following quotes:

“The Web tools we used in this process enabled us to easily publish the data we collected and save time with ready-made design templates, making our work easier and increasing our productivity. The Roar.io application made it easy for us to use AR technology. Adalo is the most user-friendly application for app development.” (Participant 1, January, 2020)

“Wix is definitely a very wide and useful application. Both template and different features. There is a lot of content and it definitely makes site creation very easy. I used UnityAR for the AR application, which is useful. You can choose what to put as an object and you can add the animation you want. It gives the user a lot of freedom in this regard. But I struggled a lot to complete the AR project in Unity. I used Sketchfab to search for 3D objects.” (Participant 14, January, 2020)

4.7.2.3 Process of PBL (pre written reflections). When students’ opinions on PBL process were analyzed, majority of them were found out to see PBL as a very effective method which made their learning more permanent, enhanced active participation, and developed the feeling of being engaged into the lesson as indicated in the following quotes:

“The PBL approach, which is a different learning model, enabled us to learn and apply new things by thinking as a team and completing each other’s shortcomings. Since we had to use many tools and resources, it gave us the ability to research and manage, so it was a productive and colorful process for us in terms of communication. However, the PBL approach in face-to-face

education could have been more effective in terms of communication and practice.” (Participant 2, November, 2020)

“We embodied our knowledge using PBL. In this way, our learning has become more permanent. Using web tools made our homework process more fun and instructive. We are very satisfied with this process. We were able to reflect the ideas in our minds in a concrete way.” (Participant 4, November, 2020)

However, regarding keeping up with the pace of tasks and their assignments, they also found out the process difficult and challenging. For instance, they specifically asserted that dealing with the deadlines and contacting with the group member for collaborative work made the process harder and stressful due to pandemic and restrictions during this period as illustrated in the following quotes:

“During the quarantine and distance education process implemented due to the Covid-19 epidemic, the PBL has put a lot of pressure on us because creating a project requires teamwork with high interaction. It was exhausting for us to exchange ideas online, communicate, distribute work and work on them remotely. We would prefer to examine the previous academic projects during the lesson and to prepare individual reports on them, with English in the foreground.” (Participant 7, November, 2020)

“It makes the team spirit feel good. It increases the sense of responsibility and it is a contribution. Due to the pandemic, the distance has forced us, and the internet situation has sometimes been interrupted. Maybe if we were close to each other, we could have added more things, but when our group was far from each other, we had a hard time and the projects took too much time.” (Participant 9, November, 2020)

4.7.2.4 Process of PBL (post written reflections). When students’ ideas on PBL process was investigated after the implementation period was over, PBL was again found out to be an effective method offering a challenging but permanent and active learning opportunity in parallel with the findings of the pre-reflections. In line with

this, majority of the students asserted PBL as developing both technical and language skills, as well as using time, working in groups, and international mindedness skills as shown in the following quotes:

“Creating a functional product increases creativity as it is the main point. Distributing what the members will do in a project, solving the problem of our friend who is stuck in one place, rehearsing when the work is done, and presenting our awesome homework at the end showed us how good it is to work on a project basis.” (Participant 5, January, 2020)

“We learned to work as a group, take responsibility, produce something in a limited time, so it contributed a lot. We have seen different ways to make use of simple applications instead of writing our own codes. I profited from alternative ways instead of wasting time to coding. This also helped us to think about the problems and try to come up with the best product.” (Participant 10, January, 2020)

On the other hand, some of the students focused on both positive and negative aspects of PBL process. For instance, while they concentrated on the benefits of PBL such as development of academic, research, collaborative, and ICT skills fostering life-long learning at the same time, they underlined some challenges and drawbacks they faced including the time-management problems and intensive workload as evident in the following quotes:

“We can say that it was very positive and enjoyable in terms of both software and English, but on the other hand, it was tiring and challenging. We felt that our English writing and speaking skills had improved, and that together with it, the ideas of collaborative work began to form. We are also very pleased that it has created an environment for us to get to know each other and establish friendships. Although this process was a bit challenging for all of us, we enjoyed our work. It helped us learn to use days and hours efficiently and to act collectively. While we were working, we completed each other’s shortcomings.” (Participant 2, January, 2020)

“PBL is a very good approach for the student to improve himself/herself in many different areas in a short time. But 3 projects in 1 semester is a bit too much for students who have 7-8 courses. As a group, we think that at most 2 projects in one semester will be very effective.” (Participant 6, January, 2020)

4.7.2.5 Group work (pre written reflections). When students’ ideas on collaboration during PBL process were analyzed, in general, collaborative work was found out to be effective in terms of fostering generating ideas, increasing responsibility, time-management and workload distribution skills and reducing the stress as indicated in the following quote:

“Positively; we were able to exchange ideas. We were able to make up for each other’s deficiencies. We were able to divide the work and do a planned work. On the downside, we had disagreements and time conflicts in some places. Nevertheless, this increased our tolerance and taught us to respect and build empathy towards each other.” (Participant 3, November, 2020)

On the other hand, as well as the positive comments in favor of group work, some of the students also pointed out the challenges and drawbacks of collaboration due to online communication problems and health care problems regarding the pandemic situation as shown in their following quotes:

“With a team spirit, group work enabled us to work in a planned and regular manner, enabling us to develop our sense of responsibility, and to complete our project more easily and quickly. The negative situation we encountered was online communication due to pandemic and we had difficulties in the adaptation process.” (Participant 12, November, 2020)

“Thanks to the group work, our project became more fun. We have produced good results by integrating different ideas. We understood the importance of timing, tasted team spirit, contribute each other, made a division of labor.

Negatively, there were moments when not everyone was available at the same time.” (Participant 15, November, 2020)

4.7.2.6 Group work (post written reflections). When students’ opinions on group work were analyzed by means of post reflections, similar to the results of the pre reflections, it was generally found put to be effective for increasing critical thinking, motivation, cooperation, and leadership as well as enhancing responsibility and time management skills in an awareness-raising, peaceful atmosphere which students feel themselves as productive and efficient as shown in the following quotes:

“I think that working with the group is beneficial because it requires both our social skills and task distribution, planning during the project process, and also gives us self-confidence.” (Participant 5, January, 2020)

“Group work was a good process for me. It was a very nice experience to listen to my friends’ ideas and exchange information. Generating ideas and sharing work made the process even more enjoyable and effective.” (Participant 1, January, 2020)

On the other hand, some of the students mentioned both pros and cons of collaborative work process similar to the pre reflections. In terms of collaboration and cooperation among group members, students had controversial ideas. Specifically, while some students think that they became more social during the pandemic thanks to working collaboratively for project development process, others argue that this pandemic made the process more challenging due to online communication problems and they underlined the fact that this process would be more effective if it was face to face as shown in their following quotes:

“Working with the group is a pleasure. Because we shared tasks, we were able to complete the assignment faster. However, since we had distance education, we couldn't come together face to face. While working as a group, communication problems sometimes occurred due to the pandemic and we had technical trouble in accessing the internet and other sources.” (Participant 2, January, 2020)

“The time passed very productively for us. With a good distribution of work, the load is reduced the only downside is the hours... 5 different people means 5 different lives. That’s why we had a hard time setting the time. Since everyone has a certain schedule and it takes a long time to work during available times.” (Participant 4, January, 2020)

4.7.2.7 PBL for writing skill (pre written reflections). When students’ opinions on whether PBL is effective or not in terms of developing their L2 writing skills, it was found out that students had positive attitudes towards the use of PBL for improving their L2 writing process specifically for fostering grammar, spelling, vocabulary, translation, paraphrasing, and transferring from paragraph to essay writing as shown in the following quotes:

“Writing compositions gave us a chance to practice. While writing continuously helped us learn new words, it also created a familiarity with the grammatical structure of the language.” (Participant 6, November, 2020)

“We think that PBL has greatly contributed to our writing skills. We had to write essays about globally qualified problems. First, we had an idea by researching the subject, then we set a good example for our writing skills by stating our own thoughts and solutions, and at the same time, we learned to write better and more understandable by dividing what we wrote into paragraphs.” (Participant 13, November, 2020)

4.7.2.8 PBL for writing skill (post written reflections). When students’ ideas on the effects of PBL on L2 writing skills were analyzed after fulfilling the third project, similar to pre reflections, it was found out that students had positive opinions of the impacts of PBL on their writing skills as they asserted that PBL enhanced their vocabulary, improved scientific writing, fostered appropriate grammatical structures, word choice, conjunctions, academic expressions, new patterns, and phrases as shown below:

“I think it contributed much to my writing skills. Because the texts we created

were more scientifically based texts, which was more difficult than the texts we normally write. Challenge resulted in success.” (Participant 4, January, 2020)

“I can say that PBL especially improved my ability to write composition. My ability to form sentences and express my problems increased. I learned various conjunctions, and my vocabulary improved.” (Participant 5, January, 2020)

In addition, students claimed to make a big progress from the first project to the third one as they benefited from both in class and out of class PBL activities as evident in the following quote:

“The expansion of our vocabulary greatly affected our writing skills. We progressed by better understanding how we should express ourselves. In the first place, my writing skills were at the zero point very seriously, but now I think that I have progressed a lot, and my prejudices against English have been broken.” (Participant 10, January, 2020)

4.7.2.9 PBL for speaking skill (pre written reflections). When students’ ideas on whether PBL is effective or not in terms of enhancing their L2 speaking skills, it was found out that students had positive opinions towards the use of PBL for improving their L2 speaking process specifically for enhancing speaking fast and fluently, developing pronunciation, increasing self-confidence via making online presentations, decreasing speaking anxiety. In addition, students emphasized the development of their L2 speaking skills thanks to the presentations and PBL activities including group discussions in breakout rooms. Specifically, they asserted that the PBL process provided them more practices and this improved their self-confidence while expressing their ideas as shown in the following quotes:

“It contributed to our pronunciation. Making a presentation encouraged us and increased our self-confidence. Actually, I had never given a presentation in English before. That’s why I got too excited at the first presentation. As I practiced, I started to speak better, faster, and more fluently.” (Participant 7, November, 2020)

“First of all, I didn’t see myself as someone who could speak English in front of 50-60 people. However, it was a necessity, and I think I gave a good speech. My group peer who was afraid to turn on the microphone in the lessons simply overcame that fear. Also, many of us were worried about being able to speak English, but as we tried, we felt better.” (Participant 9, November, 2020)

4.7.2.10 PBL for speaking skill (post written reflections). When students’ ideas on whether PBL is effective or not in terms of enhancing their L2 speaking skills, it was found out that students had positive opinions towards the use of PBL for improving their L2 speaking process in terms of pronunciation, fluency, and accuracy similar to their ideas on the pre reflections as indicated below:

“I think what I lack in English is speaking. Because we weren’t given enough opportunity to talk in middle school or high school, and in our daily life but I think I am less anxious while speaking now.” (Participant 4, January, 2020)

“PBL was beneficial for speaking English during online presentations. In terms of developing pronunciations, improving accurate and fluent speech, it had positive effects on speaking English. It helped me correct the words I mispronounced. Especially, public speaking seems to increase my self-confidence.” (Participant 8, January, 2020)

In addition, they underlined the progress on their L2 speaking skills after the completion of three projects as the projects give them opportunity for more practice and make use of English functionally. For instance, when compared to the first project presentation, they asserted to become more comfortable and self-confident while there was a decrease on their speaking anxiety as relevant in the following quotes:

“When I watch the videos, I understand that my skill has gradually improved in three projects as I can speak more fluently and accurately. Speaking English increased my self-confidence.” (Participant 13, January, 2020)

“It was the first time I made an online presentation in English, and it was quite

exciting. Explaining a project that I developed in English was useful. Because during this presentation, I tried to pay attention to many things such as correctly constructing sentences and pronouncing words. I believe that I improved myself from the first presentation to the last one.” (Participant 1, January, 2020)

4.7.2.11 PBL for 4C skills (pre written reflections). When students were asked whether PBL affected their 4Cs or not following their first project completion, they underlined the positive impacts of PBL process on their 4C skills development. More specifically, regarding their critical thinking skills, they pointed out the improvement on interpreting evidences and accurately, pros and cons of arguments during class discussions, offering alternative points of view, justifies reasons of their problem solutions and products they creating during PBL process. In terms of their collaboration skills, the students underlined their willingness in taking part in PBL activities, being a leader in group work, listening to their peers eagerly, providing feedback while cooperating with their group friends, and managing their time effectively. In line with these, as for the communication skills, students concentrated on selecting an appropriate problem solution and expressing it in an interesting way to the audience, using an effective organizational patterns, supporting their presentation via audio-visual materials, developing a conclusion that effects others ideas, making use of a careful choice of words, engaging the audience to their presentations, using gestures and body language effectively online, making use of visual aids for persuasive solutions with evidence. Lastly, for their creativity, they underlined the development of creative thinking skills via working through PBL in terms of being sensitive towards different differences, making coherent idea presentations and explanations, creating different and unique ideas. Students’ opinions of the positive impact of PBL on their 4Cs are given in a detailed and an integrated way in the following quote:

“Sorting out universal problems, reading articles, and generating ideas improved our critical thinking. Our efforts have helped us to be more careful, thoughtful and productive about such issues. At the same time, it contributed to increase our self-confidence in order to find solutions to such issues and to increase our belief that we can do it if we try. In terms of creativity, we devoted ourselves more to the subject and reached more creative ideas in order to produce solutions that are different from everyone else but that can be useful and put into action.

Expressing our opinions on different topics from different subjects facilitated our individual research. Even though we had a lot of difficulties in the field of communication, our support for each other was always at a high level.” (Participant 3, November, 2020)

4.7.2.12 PBL for 4C skills (post written reflections). When students were asked whether PBL had an impact on their 4Cs or not upon their third project delivery, in parallel with the findings of the pre reflections, they mainly concentrated on the positive effects of PBL process on their 4C skills development as well as mentioning the progress throughout this process. For instance, students asserted that there was a difference between their first and third projects in terms of the functionality and advance level of tasks for developing 4C skills as shown in the following quotes:

“During this process, we criticize each other’s ideas with a critical lens. As we work as a group, we work in cooperation with each other, we brainstorm to produce new ideas, so it contributes to 4Cs. It had an impact on critical thinking because sometimes there was more than one idea among ourselves, we evaluated them, we selected them, we evaluated other groups in the presentations. In terms of creativity, everyone thought to produce something, so this also benefited. Since we are already working as a group, our spirit of cooperation has improved. Collaborative communication is required, so even though we never saw each other, we were fused.” (Participant 4, January, 2020)

On the other hand, some of the students mentioned the challenges of PBL process for enhancing specifically communication skills even though they had positive opinions on the improvement of 4C skills in general as relevant in the following quote:

“Although it was difficult and challenging to communicate in this group assignment, we did remotely, our communication skills inevitably improved as we were all in constant contact with each other during this process. Each of our group member tried to help for the tasks, which developed our cooperation skills. Everyone had a different opinion on the subject, so we thought in detail and commented on the ideas in order to get the right point of view. As we thought

about the subject and went into details, creative ideas emerged and our critical thinking has been improved.” (Participant 10, January, 2020)

4.7.2.13 PBL with reference to SDGs. This section presents the students’ opinions on the integration of SDGs into PBL process in detail.

4.7.2.13.1 Background knowledge on UN’s SDGs and SDGs as the content of the projects (pre written reflections). When students’ background information on SDGs was investigated within pre reflections, it was found out that majority of the students had not heard of these global goals before the projects. However, only a few of them stated that they knew these goals from social media and internet. In addition, almost all of the students underlined the importance of integrating these real life authentic issues into projects as they were recent, concentrated on both the local and global context, related with trend topics requiring the awareness of every single person. In a similar vein, they also highlighted their positive thoughts on appreciating the content of their projects via stating that these global issues helped them to become active problem solvers of world problems and raised their awareness on contemporary struggles the world fought against recently as clear in their following quote:

“No, we were all unaware of the existence of these goals before. In our project, with Kargomat, we tried to end hunger and realized the magnitude of waste in our country. We became aware of the problems that we ignored. We have realized that it is not easy for everyone to eat a meal that is very easy to reach for us. Most importantly, we realized once again that not everyone lived under the same conditions and with the same equality.” (Participant 7, November, 2020)

Specifically, one of the students made use of a metaphor via resembling project development to a tampon to show that the problem solutions and engaging into these issues were essential although it was almost impossible to completely solve them as shown in the following quote:

“This is what I think about projects: It is like putting a tampon to a person who's

been stabbed in the heart, it might slow the blood down, but it won't stop it.”
(Participant 10, November, 2020)

4.7.2.13.2 Background knowledge on UN's SDGs/SDGs as the content of the projects (post written reflections). Regarding the students' background information on SDGs, majority of the students were found not to have heard of these global goals before the PBL as they also claimed in their pre reflections. However, only a few of them stated that they knew these goals from magazines and online sources as shown below:

“We have heard it from magazines and media, but I did not know that such a comprehensive study was carried out for these goals. However, I gained a lot of knowledge thanks to the studies we have done since the first homework. We attached great importance to applicability in our projects as there is also a need for volunteers like us and we should do our best.” (Participant 2, January, 2020)

Regarding the content of the projects, they stated that they became aware of the significance of these global goals, increased their problem solution skills and felt to be the part of a solution rather than the problem as clear in the following quote:

“We had heard from social media before, but we did not have enough information. Thanks to our projects, we have become more conscious and more sensitive to social issues. It was an experience that helped me learn my responsibilities for solving these problems. I became solution-oriented rather than problem-oriented.” (Participant 1, January, 2020)

4.7.2.13.3 Individual roles in accomplishing the SDGs (pre written reflections). When students were asked about their roles in taking action for the SDGs through the pre reflections, it was found out that majority of them were in favor of their own individual responsibilities of achieving these global goals by means of raising awareness of their local and global community, trying to be a productive activist and a creative problem solver as seen in the quotes:

“We realized that finding individual solutions creates a domino effect. First, we need to take action by ourselves. If we change ourselves, our environment will change. If our environment changes, the world will change. The important thing is to take the first step.” (Participant 7, November, 2020)

“Instead of looking for a rescuer, we should be the rescuer. Thanks to the website we built, we have made it easier for people living on the street to access food more easily. Thanks to such applications and sites, people can be more informed and we can act faster on the solution.” (Participant 11, November, 2020)

In addition, one of the students underlined the importance of taking the support of the government and big companies for financial support as evident in the following quote:

“As humanity, we think that after individual awareness, states and large companies should take responsibility in line with these goals. The capitalist system that the world is in and the inadequacy of ethical and moral awareness ingrained in the personality of some people prevent us from taking action and taking a role in line with these goals.” (Participant 13, November, 2020)

4.7.2.13.4 Individual roles in accomplishing the SDGs (post written reflections).

When students were asked about their roles in attaining the SDGs, it was found out that majority of them believed that they could make a difference as individuals in terms of gaining consciousness, taking responsibilities for achieving the goals on their own, expanding the solutions from local to global, fighting for the problems hand in hand as a community as indicated below:

“I think raising awareness is a big step towards a solution. I think these problems can be solved if we all work together. We can also do this with social media” (Participant 2, January, 2020)

“We didn’t think we have a role until we started working on such projects. Then, we saw how we could be influential. Not only as individuals, but also as a society, we can change many things.” (Participant 12, January, 2020)

In addition, regarding the post reflections, different from the pre ones, students highlighted that they can personally change their roles from passive to more active agents for achieving the goals. For instance, instead of just raising awareness on the goals, they considered the significance of taking actions personally and then as a whole society as evident in the following quotes:

“First of all, we should realize what we can do individually and make an effort to achieve the goals. Then we should do something micro and then try to spread this effect to the whole society. We can raise awareness, organize aid campaigns, make donations and hold seminars.” (Participant 15, January, 2020)

“The most important thing is to raise public awareness. Instead of waiting for a superhero, that superhero can be anyone. I mean, we cannot always expect others to get something done. We can find solutions to such problems not by waiting, but by taking action.” (Participant 4, January, 2020)

4.7.2.13.5 Final remarks on SDGs (pre written reflections). When students were asked for their ideas on SDGs upon completing their first project, they specifically underlined the significance of being united and essentiality of creating awareness for solving problems. Additionally, majority of the students found themselves responsible of solving these global issues and feel themselves self-confident, eager and encouraged to be the part of the taking action community as relevant in the following quotes:

“We believe that there is much we can do about this issue. We became aware of how important it is, rather than just providing success as a homework. We witness that even small touches can open a big door for us. (Participant 8, November, 2020)

“The articles about how the teenagers around the world could find a solution to these issues in such a short time impressed us a lot. At first, we did not think it was possible to solve this issue in such a short time. As we examined the projects, our faith increased depending on the projects and the interest of the public. I believe that our solutions to the problems will resolve the problems in a shorter

time.” (Participant 9, November, 2020)

4.7.2.13.6 Final remarks on SDGs (post written reflections). When students’ ideas on SDGs upon completing their third project were sought, they asserted that their ideas on the achievement of the projects and responsibility of solving problems had changed. For example, after the first project they claimed that it was the government’s job to provide solutions. However, upon finding out more authentic solutions to these global goals on their own via projects, they believed in themselves personally and this increased their awareness, consciousness and cooperation skills as shown in the following quotes:

“Although the goals are difficult to achieve, if the whole world joins hand in hand and when we act together, we can overcome all problems.” (Participant 2, January, 2020)

“No problem is too difficult to be solved, as long as appropriate moves are taken at the appropriate time. Every individual should do his best for society and the world. The basis of development is the individual. Everyone should have the necessary awareness and do their part for the world and for development. This is how big projects will emerge.” (Participant 3, January, 2020)

In brief, students’ final remarks on the PBL included empowerment and perseverance upon development of ICT, teamwork, creativity, critical thinking, and problem solving skills; enhancement of in-depth enquiry, active exploration, curiosity, self-confidence; changing their roles as active agents for taking actions to world problems via creating their original, authentic projects; enhancing their autonomy while raising their voices to reflect their choices as evident in the following quotes:

“This is the way I want to learn as it was an eye-opener process for real world issues. Working on a project, I learn to manage obstacles more effectively, often learning from failure and possibly starting over from scratch.” (Participant 10, January, 2020)

“We take ownership over our projects, reflecting on and celebrating our progress and accomplishments. It was like challenging the challenge. We learn to look at problems with a critical thinking lens, asking questions and coming up with possible solutions within groups for our project.” (Participant 12, January, 2020)

“We get to explore our curiosities, find our voice being appreciated within group work and learn to take pride in our work.” (Participant 15, January, 2020)

In summary, when students pre and post reflections were analyzed, it was found out that majority of the students found ICT tools practical, user-friendly, time-saving, and beneficial. Different from the findings of the pre written reflections, post reflection papers indicated that students became more competent in using web-tools, became autonomous learners for reaching and making use of recent tools, dealing with technical stuff on their own and benefiting from available online sources. Regarding the process of PBL, pre and post reflections were in parallel with each other as PBL was found out to be an effective method offering a challenging but permanent, enjoyable and active learning opportunity for students. On the other hand, some challenges they asserted included the time-management problems, intensive workload, and online communication and collaboration among group members in pandemic context. In terms of group work, both pre and post reflections again indicated that working in groups was generally found put to be influential for increasing 4Cs while some drawbacks including online communication problems as well as pandemic were underlined. When students’ ideas on the effects of PBL on L2 writing skills were analyzed not only pre but also post reflections revealed that students had positive opinions through the impacts of PBL on their academic writing skills for enhancing their vocabulary, making use of appropriate grammatical structures, conjunctions, and spelling. In line with this, PBL was found out to be efficient for improving L2 speaking process in terms of pronunciation, fluency, and accuracy whilst decreasing their speaking anxiety. In addition, students appreciated PBL for making a progress from the first project to the third one in terms of developing their productive skills as well as their 4Cs as students emphasized the difference between their first and third projects in terms of the functionality and advance levels. Regarding the students’ background information on SDGs, majority of the students were found not to have

heard of these global goals before the PBL. However, they felt engaged with the content of the projects as they were found out to be highly pleased with becoming aware of the significance of these global goals and increasing their problem solution skills. In terms of their roles in attaining the SDGs, both pre and post reflections indicated that gaining consciousness, taking responsibilities for achieving the goals on their own, expanding the solutions from local to global, fighting for the problems hand in hand as a community were significant for them. In addition, regarding the post reflections, different from the pre ones, students highlighted that they can personally change their roles from passive to more active agents for achieving the goals. On the other hand, upon completing the third projects, students were found out to become more aware, responsible, and conscious for providing solutions to these global problems.

4.8 Findings for Research Question 7

The last research question was addressed to find out the opinions of the lecturer on the implementation of the ICT-Assisted PBL. Grounded on this, field notes kept by the researcher during the implementation process was analyzed by means of Content Analysis. Two sub-categories were emerged from the data regarding the main benefits and challenges of the implementation process.

4.8.1 The main benefits of the ICT-Assisted PBL. Two major themes were identified based on the examination of raw data obtained through field notes in order to depict the lecturer's perceptions on the principal benefits of the ICT-Assisted PBL. Accordingly, two themes included gains of students and gains of the trainer.

4.8.1.1 Gains of students. In parallel with the findings obtained through semi-structured interviews and written reflections of students during the PBL process, the field notes of the researcher as the lecturer of the applied program also revealed that the ICT-assisted PBL resulted in significant gains for students. As aforementioned, the students have become more knowledgeable, aware and active participants as reflected in their written reflections and practices during PBL process. As EFL learners, they were able to enhance their knowledge on SDGs, develop L2 productive skills, as well

as their 4C skills, and improve ICT competencies. Besides, the students have become aware of the fact that they are a part of community necessitating collaboration for better and effective learning in L2.

4.8.1.2 Gains of the lecturer. As the researcher was also the lecturer of the program, the PBL instruction also resulted in significant gains for her as well. In addition to its benefits for the students, the implementation also enabled the lecturer to become more knowledgeable, aware and active. This mainly stemmed from the fact that the lecturer herself also had some but limited prior knowledge about the main concepts and implementation process of the ICT-assisted PBL and integration of these practices into language classroom instruction. In order to implement ICT-assisted PBL efficiently, the lecturer first tried to train herself and applied what she had learnt in a real classroom context regarding the piloting phase. During the process, the lecturer benefitted from numerous resources such as books, articles, documentaries, video clips, news reports etc. Besides, as well as this theoretical knowledge, the lecturer also attended various ELT seminars and workshops regarding the PBL integration to EFL classes, technology support in ESL, development and assessment of 21st century skills in ELT, AR and Mobile App development. In addition, the lecturer has become more aware of the importance of collaboration and ICT competencies thanks to the process and students' reflections. In addition, the current implementation of PBL enabled the lecturer to have a better research experience thanks to her dual role. Finally, the current PBL methodology enabled the lecturer to have better ideas for her future in class and out of class practices regarding the implementation of the ICT-assisted PBL in the light of the challenges that she faced during such implementation.

4.8.2 The main challenges of the ICT-Assisted PBL. In addition to some benefits, the lecturer also identified the main challenges of the implementation of the PBL. In that sense, five major themes were identified through the analysis of field notes. The themes comprised of duration of the program, class size, students' changing motivation, students' background and students' personal problems during the pandemic process.

4.8.2.1 Duration of the program. As the researcher had 14 weeks allowing 56

hours in total to conduct the research, the PBL process including three different project development, making three presentations, and writing three problem solution compositions was too intense. It was due to the researcher's wish to cover different goals within the ICT-assisted PBL process and to give each of the students a chance to deliver at least three presentations and write three compositions during the term. In addition, the researcher aimed to develop students' engagement of emerging technologies and support their use of different web 2, 3, and 4 tools. In order to deal with it, the researcher was always in a close contact with the students via what is app groups, EDMODO, TEAMS, zoom meetings, as well as online lessons. The lecturer also designed the implementation process, organization of group members and due dates according to students' school schedule and tried to take students' ideas in each process via their written reflections and instant feedbacks after each lesson. By means of engaging with the students in each step, the lecturer had a chance to provide students immediate support, help, and assistance when they needed. As the ICT-assisted PBL process included intensive practices, the lecturer covered in class activities and out of class assignments regularly and gave students instant feedback on their progress. Thereby, the researcher had a chance to observe the process in a more detailed, in-depth manner. Besides, the researcher occasionally dealt with time management problems in online classes. Apart from this, because of time constraints, the time for group and class discussions was sometimes limited although the lecturer benefited from breakout rooms during TEAMS lessons. Some of the students complained about the intensity of the implementation process and the lack of time for discussions and creation of projects as indicated in the following statements:

"I wish we didn't deal with 3 projects. Instead, we may focus on more and get rid of too many deadlines. It makes me feel stressed."

"There are too many tasks, and each project has its own set of objectives and ICT tools. Why don't we have more time to focus on only one or two projects instead of three different projects, goals, presentations, and compositions?"

4.8.2.2 Class size. In the current study, there were 60 students in each section of the experimental and control groups as participants. As a result, the number of students had an impact on how much one-on-one time the lecturer could spend with each of the

online participants. Grounded on this, the lecturer devoided of an easy-to-manage context due to the huge class size. In addition, there became too many groups the lecturer had to manage and observe during in-class and out of class practices.

4.8.2.3 Students' changing motivation. The students' motivation was one of the challenges, specifically reported in the very beginning of the study due to students' inexperience on ICT-Assisted PBL before. As the PBL process lasted for 14 intensive weeks and required students to work hard and collaboratively within project groups by means of not only creating authentic projects, presenting unique solutions to global problems, but also writing problem-solution compositions in an academic way; sometimes students felt exhausted and were not very willing to take part in all of in-class activities and out of class assignments with the same motivation, enthusiasm and excitement during the process. However, right after the teachers' instant support via regular meetings online, students' attitudes towards such an instruction was changed abruptly, and they felt highly motivated to fulfill the requirements, participate in the activities, and became active agents. Nevertheless, the students were occasionally frustrated by the restricted time allotted for each activity specifically due to deadlines as stated below:

“At first, it was hard for us to get used to PBL as this was the first time we were required to work in groups and create a project on real world problems.”

“To be honest, sometimes I am not eager to participate in every step. The process is tiring. However, what we do is graded and both the group mates and the teacher support me a lot. Also, the will to finish the projects and present them make me feel engaged again!”

“Sometimes what we do is too intense and I am not able to follow what is going on online. Does it have to be so fast?”

In addition, as for the group-work, the students sometimes complained about their groupmates' lack of motivation to accomplish the task. They had difficulty in getting in touch with each other every time due to pandemic and online communication

challenges. This also made them feel restricted and block their intrinsic motivations. Even though they requested to change their group members because of these communication difficulties with them, the researcher did not give permission because of time constraints. The complaints of the students are as follows:

“I do not want to be a part of this group. I do not have to encourage them to complete the assignment all the time. I wish I could create my own project individually rather than with a group.”

4.8.2.4 Students' background. As the students were sophomores who had no background knowledge and experience on SDGs and PBL instruction beforehand, the researcher had to systematically plan and apply the research in order not to face challenges. However, the piloting also made the process easier to give feedback on the duration of the PBL activities and general in-sights on the implementation stage for the real study. In addition, it was challenging for students to get used to work collaboratively within online education during pandemic. Besides, this new instruction including different contents, requiring academic efforts for productive skills and 4C skills at the same time, integration of new ICT tools cause some concerns with regard to the project development process. Meanwhile, the researcher provided additional support especially on how to integrate ICT tools and SDGs into their projects. That created a more intense program. On the other hand, after some time, the students felt more comfortable with the instruction itself while being aware of their capabilities to follow and make use of available online materials, due dates of the assignments. In addition, although participants included B1 level students who had appropriate language levels of achieving the objectives of the lesson, they still had difficulty in fulfilling the requirements while presenting their projects and writing compositions as they were found out to be inexperienced in these practices during their L2 learning process before. As indicated in their reflections, it was the first time for the majority of these students that they made online presentations, worked within groups, created projects, and wrote compositions. Therefore, the researcher tried to make the process easier for everyone and students' each project, which was evaluated according to 4C rubrics and productive skills rubrics were taken as their final grades valid for their reports. In addition, all of the necessary information and materials were shared online

by means of TEAMS platform at the very beginning of the implementation period via taking the students' vocational course schedules into consideration. For instance, their quizzes, tasks and assignments never came across with the other courses. Thanks to well-designed weekly-syllabus, all of the students had a chance to know the requirements and what was expected from them at least a month before. As all of the lessons and sections were recorded, the students had an opportunity to make-up the lessons via Stream videos and available dossiers in TEAMS class materials. As the researcher provided the students the functions and useful language, learning outcomes, and suggested materials and tasks in relation to the content of each week, the students were solely expected to engage in the PBL process actively. After gaining experience on how to create projects, follow the PBL practices systematically, make use of appropriate web tools and integrate SDGs into their projects, the students were asked to deliver their final products, which made them feel more comfortable, active, and self-confident with the whole learning process itself.

4.8.2.5 Students' personal problems during the pandemic process. The biggest challenge that the researcher and lecturer faced was found out to be the pandemic affecting students' not only psychological but also physical and mental health conditions, and hindering motivation, decreasing concentration span during online lessons, dealing with financial situations for providing technical stuff, equipment, internet, etc. In addition to these problems students came across because of Covid-19 and quarantine process, they also had difficulty in communicating with each other and attend online courses even they were highly eager to participate in every phase of the process. This obligatory context made the lecturer feel stressed as well as helpless in some occasions. However, in time, both the students and the lecturer were used to fight against the struggles of the Covid process and managed to use time efficiently, compensate the limited facilities, have constructive and supportive attitudes towards all challenges via becoming knowledgeable, aware and active for the rest of the world.

In summary, ICT-Assisted PBL was found out to be an effective methodology, which provided gains not only for students but also the lecturer. From students' sides, it was influential for the development of productive skills, the 4Cs, enhancing their autonomy, as well as their ICT competencies. In a similar vein, in lecturer's side, PBL

implementation process was beneficial for both the professional development and life-long learning process. However, duration of the program, class size, students' changing motivation, background and the pandemic process were found out to be challenges of the PBL process.



Chapter 5

Discussion and Conclusion

5.1 Introduction

In this chapter, first the overview of the findings of the seven research questions that this research set out to answer regarding the impacts of the ICT-Assisted PBL on not only the L2 productive skills but also the 4C skills of the students will be discussed through their comparison with the relevant research and possible underlying reasons behind these findings will be highlighted. Upon elaborating on specific conclusions from the findings for each research question, pedagogical implications for research in relation to ELT programs will be provided. Lastly, suggestions for further research will be set forth.

5.2 Discussion of Findings for Research Questions

The purpose of this study was to explore the implementation of ICT-assisted PBL in EFL classrooms at tertiary level, particularly in General English Programs. To this end, the present study investigated several aspects of the phenomenon first by examining the effects and practical reflections of the integration of ICT-Assisted PBL into ELT Pedagogy to develop students' 4C skills and L2 productive skills with reference to the UN's SDGs. Second, it aimed to find out EFL students' C 21 skills' levels, perceived learner autonomy levels, and identify their perceptions about such integration. Moreover, possible benefits and challenges may be met by the teacher during such implementation were sought. In order to answer the research questions, the quantitative data were collected through the series of pre and post questionnaires and rubrics whereas the qualitative data were collected through the pre and post interviews with the students, pre and post written reflection papers of the students and field notes kept by the researcher during the implementation of the PBL instruction.

5.2.1 Discussion of the findings for research question 1. The first research question aimed at determining whether there is a statistically significant difference in students' level of 4C skills. The results revealed that there were statistically significant differences in students' level of 4C skills in all dimensions including critical thinking,

collaboration, creativity, communication after being exposed to the ICT-Assisted PBL instruction. These results of the present study regarding changes in 4Cs are compatible with previous studies that so far have focused on the impacts of PBL on students' 4Cs in language classes and asserted PBL as promoting students' communication skills (Bakar et al., 2019; Chang, 2014; Farouck, 2016; Kovalyova et al., 2016; Lubis et al., 2018; Maulany, 2010), and providing students opportunities to deal with an authentic global concern and develop collaboration skills in pairs or groups (Levin-Goldberg, 2012) as well. To begin with, PBL has also been reported to foster students' communication in the Bulach's study (2003) which investigated students' reactions to learning communication in a PBL setting. With this goal in mind, sixty-eight third grade female students majoring in English Literature at a women's university in Tokyo were divided into groups of four or five and made interviews on cultural issues. The findings obtained from the students' questionnaires and journals revealed that PBL is an instructional approach for teaching English communication to Japanese university students. In terms of critical thinking skills, Rochmahwati (2015) conducted a qualitative research in EFL context, which aimed to foster students' 21st century skills through PBL and found that the implementation of PBL resulted in an increase in the students' critical thinking as well as other 21st century skills. In a similar vein, Gilroy (2016) conducted an exploratory research conducted to understand the different skills students practice through projects where four language skills and vocabulary are combined with 4Cs and problem solving. The results revealed that in addition to developing presentation skills, the ISPs were also effective in developing many other 4Cs. Among these skills, critical thinking skills were reported to occur with higher frequency during ISP practices. In a more recent pre-experimental research, Bani-Hamad and Abdullah (2019) explored the effect of PBL on improving 4Cs among secondary level students. The findings revealed that there were statistically significant differences between students' pre and post test results in terms of their levels of 4Cs. Also, the findings indicated that students are less capable in creative and critical thinking compared to their skills in communication and collaboration skills.

5.2.2 Discussion of the findings for research question 2. Initially, the second research question aimed at determining whether there is a statistically significant difference between students who receive traditional instruction and those who receive

ICT-Assisted PBL instruction in terms of L2 speaking skills. The results of the present study regarding changes in L2 speaking skills are in line with many studies that so far have focused on the impacts of PBL on students' speaking skills. Initially, the results obtained from the speaking tests revealed that although there was no statistically significant difference between control and experimental groups before the implementation, a statistically significant difference was found between these two groups of students regarding their speaking skills after PBL instruction. Accordingly, the ICT-Assisted PBL instruction resulted in a huge effect in the speaking skills of the experimental group. The results were in parallel with the previously mentioned studies in literature which have found that the PBL approach enhances students' speaking skills. For instance, an action research conducted by Maulany (2013) at a primary school in Bandung examined whether PBL could improve young learners' speaking skills or not. By means of comparing the pre- and post-test results, students' speaking skills including comprehension and vocabulary aspects were found to be improved. Likewise, Areej and Hamzeh (2014) conducted a quasi-experimental study examining the impact of a PBL on oral performance skills development of 80 randomly selected tenth grade EFL students Um Nowareh secondary public school in Amman and their attitudes towards these oral skills were also investigated. Data obtained by means of an oral performance test, an oral attitude survey, and a rating scale highlighted that there was a statistically significant difference in tenth grade EFL students' mean scores regarding their oral performance and their attitudes towards oral skills in English, in favor of the students taught via PBL. In line with this, in a study conducted by Zare-Behtash, Khoshshima and Sarlak (2016), two homogenous groups of college students in a general English course were divided into the control group underwent a conventional teaching method and the treatment group underwent a PW method. As a result of the pre- and post-test comparisons, participants were found to have improved their speaking performance significantly upon having been exposed to 10 sessions of speaking instruction based on PBL approach. As the results indicated significant improvement in favor of the experimental group, the PW method was recommended as useful for teaching speaking method as also suggested in the current study. Similarly, in the Colombian context, Vaca Torres and Gómez Rodríguez (2017) investigated how a group of ninth-graders improved their speaking skills in an EFL classroom using the PBL approach. During the implementation process, 30 EFL ninth

graders worked in small groups to accomplish three projects. The data obtained through field notes, oral performance of students, and interview showed that PBL fostered students' oral production with regards to lexical competence development, overcome fears of speaking English and raise their interest in learning about their school life and community. In another recent quasi-experimental study, Bakar, Noordin and Razali (2019b) sought the impacts of implementing the PBL in developing the oral communicative competence of Malaysian English language learners. During the 16-week implementation process, 44 technical college students were taught the Communicative English course via using the PBL. Data collected by means of a speaking test and a listening test, administered as pre- and posttest, and a student questionnaire administered at the end of the study indicated a significant development in the overall oral communicative competence of the students. In another contemporary study, Winasih, Cahyono and Prayogo (2019) investigated the impacts of PBL on students' speaking ability by means of an e-poster. Two randomly assigned intact classes including 61 students at a vocational high school in Indonesia were administered pre- and posttest. The students instructed through PBL using E-poster were found to significantly outperform those taught through a conventional method. As aforementioned, the results of these previous studies conducted in various EFL contexts complement with the current research as suggesting PBL as an effective method fostering L2 speaking skills.

Secondly, this research question also aimed at examining whether there is a statistically significant difference between students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of L2 writing skills. The results obtained from the writing test illustrated that upon the treatment, there was a statistically significant difference between control and experimental group students in terms of their writing skills and the treatment was found to result in a huge effect on the writing skills of experimental group students who received PBL instruction. These results were in accordance with the study of Syarifah and Emiliasari (2018) who investigated the use of PBL to develop students' abilities and creativity in writing narrative text and the students' perception about the implementation of PBL in a writing course. The participants consisted of second-semester students of the English language education at a private university in Majalengka at West Java and were

expected to produce a book including narrative stories about different topics. The data obtained from the field notes, final products of the project, and the pre- and post-interviews revealed that writing skills as well as their understanding of the topics they wrote, social functions, structures, and linguistic features of narrative essay were increased. In addition, in terms of their perceptions, “almost all students gave positive responses. They argued that working on projects was more fun because they could determine the final project output based on their interest and agreement” (p. 91). In a similar vein, the positive outcomes of PBL on L2 writing skills were in line with the findings of the other previously mentioned studies in the reviewed literature which focused on the effective implications of PBL on students’ L2 writing skills specifically in tertiary education (Affandi & Sukyadi, 2016; Aghayani & Hajmohammadi, 2019; Irawati, 2015; Sadeghi, Biniiaz, & Soleimani, 2016; Sa’diyah & Cahyono, 2019; Sukmawati, 2020). For instance, Irawati (2015) found that the application cultural PBL developed ELT students’ academic writing in terms of content and vocabulary. In another college study, Affandi and Sukyadi (2016) asserted that PBL improved the students writing achievements. With a parallel study, Sadeghi, Biniiaz, and Soleimani (2016) investigated the impact of PBL on comparison and contrast paragraph writing skills of Iranian EFL learners. After 10 weeks of PBL instruction, the results indicated that the experimental group students who were educated by PBL outperformed the students who were taught through the student textbooks based instruction. Furthermore, Aghayani and Hajmohammadi (2019) investigated the effect of PBL on EFL learners’ writing skill in Iran context and following two-month treatment, PBL was found to have a significant effect on the learners’ writing ability in a collaborative environment. In another recent study in Indonesian context, Sa’diyah and Cahyono (2019) found out that the students using PBL through blogging got better scores in writing than the ones using the conventional method. Lastly, Sukmawati (2020) conducted an exploratory action research to examine whether the PBL intervention is able to improve the students’ skill in writing a descriptive text and concluded that PBL activities enhanced the students’ engagement and directed them in accomplishing the tasks.

Regarding the overall language skills and academic success, in line with the findings of the current study, previous studies in the literature also highlighted that

students developed their language macro-skills and academic achievement in EFL learning process following the PBL. For example, in Greek context, Fragoulis (2009) found out that 15 participants at a primary school expressed having enhanced all four-language skills specifically speaking and listening after six months PBL process. In a parallel study, in a Thai EFL university, Simpson (2011) investigated the impacts of PBL on students' English proficiency, learning skills, and self-confidence. 26 third-year students were divided into three groups according to their pre-test scores. The mixed method data showed that PBL had a statistically significant effect on the improvement of low and medium achievers' English skills whilst the high achievers were found to progress particularly in speaking and writing. In a similar vein, Poonpon (2018) examined learners' opinions on how PBL in a language classroom affect learners to apply their language skills and content knowledge to accomplish a task. Forty-seven undergraduate EFL students were asked to work in groups to complete an interdisciplinary-based project. The findings obtained from the semi-structured interviews revealed that "the students perceived that their reading, writing, and speaking skills, as well as vocabulary knowledge and translation skill, were improved because they used these skills to acquire, analyze, and synthesize information as they worked on their project" (p. 8). In another study, Nassir (2014) investigated the impacts of the PBL strategy on 76 ninth-graders language achievement levels and their attitudes towards English within Palestinian EFL context. The analysis of pre- and post-achievement tests and an attitude scale revealed that the experimental group outperformed the control group regarding both their achievement, and attitude levels, which were reported to have changed positively. In another study, Newprasit and Seepho (2015) aimed to incorporate PBL into regular foreign language teaching situations and examine whether students develop their overall language skills. Data was collected from a single-group forty-seven students at a university in Thailand by means of pre and post written and speaking tests, student diaries, portfolio assessment, and semi-structured interviews. The results illustrated that the overall English language skills of the participants increased significantly after being exposed to the PBL. In line with this, Putri et al. (2017) investigated the influences of PBL on twenty-eight seventh grade students' English productive skills and how the activities affect the teaching and learning process in a public junior high school in Bali-Indonesia. The analysis of the pre and post speaking and writing tests, an interview guide, along with

an observation checklist, an open-ended questionnaire, and field notes revealed significant effects of PBL on students' productive English skills and students reported PBL as developing their enthusiasm, confidence, creativity, self-directed learning, and collaborative learning skills. These findings were parallel with the current research as PBL was found to have significant impacts on EFL learners writing, speaking, 4C skills and students had positive opinions on using the PBL for enhancing their language and 4Cs in an integrated way. In addition, Putri et al. (2017) concluded that teachers also found PBL effective for promoting teaching motivation and satisfaction. The findings elicited through the field-notes in the current research revealed PBL increased the lecturer's motivation and eagerness in teaching. In Turkish context, Baş (2011, p.9) investigated the effects of PBL on ninth-grade high school students' academic achievement and pre- and posttest results indicated that experimental group outperformed the control group in terms of academic achievement at the end of the four-week implementation.

5.2.3 Discussion of the findings for research question 3. The third research question aimed to reveal whether there is a statistically significant difference between the students who receive traditional instruction and those who receive ICT- Assisted PBL instruction in terms of their perceived levels of L2 speaking and writing self-efficacies. The results obtained from the L2 self-efficacy scale revealed that upon following two different ways of instructions, there was a statistically significant difference between control and experimental group students' perceived levels of both L2 speaking and writing self-efficacy. These results were in line with the findings of the study conducted by Yaman (2014) who examined the efficacy of PBL on EFL students' attitudes towards the development of speaking skills by means of administering pre- and post-treatment attitude inventories, pre- and posttests, and set for post-study interviews to the two randomly selected groups enrolled at the prep school at Ondokuz Mayıs university. The researcher provided 25 different topics for PPBL. Upon completing each project, after one semester of treatment, the statistical analyses indicated a statistically significant difference between the experimental and control groups in terms of attitude and speaking proficiency dimensions as well. Moreover, similar to the present research, the findings of the Yaman's study revealed that the PBL group students had more positive attitudes towards the course and

development of their speaking self-efficacy compared to the control group students, receiving traditional instruction. Regarding speaking self-efficacy, Mills (2009) also examined how PBL enhanced students' level of self-efficacy, or perceived competence within a French foreign language context. The participants, included forty-six beginner level college students at United States, were asked to travel virtually to different places across Europe every week and write their experiences in a travel diary for creating a personal guidebook. According to the analysis of a self-efficacy survey, pre- and post-tests, significant improvement was found in students' communication self-efficacy after participating in the PBL course.

The results also indicated statistically significant difference between pre and post test scores of the control group students' L2 productive skills and perceived self-efficacy levels of these skills' as well although there is still significant difference between two groups in terms of their productive skills and writing and speaking self-efficacies at the end of the PBL. This means that when EFL learners received language input and exposed to intensive learning practices such as various collaborative tasks, three presentations, three problem-solution essay writing on global issues with ongoing feedback through online session, they had an opportunity to develop their writing and speaking skills in an EFL context.

5.2.4 Discussion of the findings for research question 4. The fourth research question aimed to investigate whether there is a statistically significant difference between the students who receive traditional instruction and those who receive ICT-Assisted PBL instruction in terms of their self-perceived autonomy levels. The results elicited from the LAS revealed that after following two different ways of instructions, a statistically significant difference was found between control and experimental group students indicating a large effect on the self-perceived autonomy levels and its sub-scales. While the experimental group students' pre and post scores showed statistical significance in terms of their level of self-perceived autonomy with a huge effect, the traditional instruction did not result in any statistical and practical significance in terms of self-perceived autonomy of the control group. These results were supported by the previous studies in the recent literature, which revealed that PBL promoted language learners' autonomy. To begin with, Imtiaz and Asif (2012) examined the effects of

PBL on fifty-two female students' autonomy in the context of English Access classrooms in Pakistan. The data obtained from the students' questionnaires, interviews, and focus group discussions highlighted that, similar to the results of the present study, PBL fostered students' language skills as well as their autonomy. Likewise, in Irawati's (2015) study, participants were found to have admitted to become more independent after completing their projects. Similarly, with the purpose of exploring the role of project work on learners' autonomy within an ESP class in Colombia, Diaz Ramírez (2014) conducted an action research study with 16 environmental engineering undergraduate students at the university. Upon creating a magazine about environmental issues over an academic semester, the data gathered through students' field notes, semi-structured interviews, questionnaires, artifacts, and video recordings showed the development learner autonomy in terms of "making decisions through cooperative work, the development of self-regulation, and intrinsic motivation" (p. 65). In line with these studies, in another study conducted by Loi (2017) in Vietnam context, the effects of project work in teaching English language skills on students' learner autonomy in an English language teacher education program was investigated over two consecutive semesters. Fifty English teaching-majored second graders completed two projects including creating a videotaped skit, report, story, or any production regarding a topic or an issue in the course and generating a booklet, manual, or guidebook on the course topic. Following the completion of these two projects, the learners' autonomy assessed via a self-assessment questionnaire and two group interviews indicated that learner autonomy of students, specifically self-decisions on learning aspect, was developed in a higher degree after PBL. On the other hand, other aspects of learner autonomy, such as self-regulated learning actions, self-responsibility, and attitudes to social interaction, remained unchanged. This result is in contrast with the findings of the current research as both aspects of learner autonomy including independence of learning and self-study habits were found to be enhanced after participating in PBL. Furthermore, Yuliani and Lengkanawati (2017) explored the impacts of PBL on six ninth grade junior high school Indonesian learners' autonomy in an EFL classroom. Upon working in groups and writing three journals about three PBL stages including planning, implementation, and monitoring stage; the data obtained from students' journals, classroom observations, and interviews revealed that PBL improved learner autonomy regarding self-instruction, self-direction, self-

access learning, and individualized instruction.

5.2.5 Discussion of the findings for research question 5. The fifth research question aimed to investigate whether there is a statistically significant difference in the perceptions of students regarding PBL qualifications. The results elicited through PBL Self-efficacy Scale revealed that ICT-Assisted PBL instruction resulted in statistically significant differences in participants' scores in terms of their PBL qualifications and its sub-scale levels in all dimensions including introduction to project qualifications, group work, project self-control qualifications, conducting project qualifications, and project finalization qualifications.

The same question also aimed to find out whether there is a statistically significant difference in the perceptions of students regarding 4C skills and the findings obtained by means of the 21st Century Skills Scale revealed that ICT-Assisted PBL instruction resulted in statistically significant differences in the participants' perceived self-efficacy levels of 4Cs and its sub-scales in all dimensions, namely critical thinking, collaboration, creativity, communication after being exposed to the ICT-Assisted PBL. Similarly, Vicheanpant and Ruenglerpanyakul (2012) examined students' and a teacher's attitudes towards PBL for fostering students' learning English communication more effectively with a positive attitude. The data gathered by means of using students'/teachers' reflections on classroom projects and semi-structured interviews indicated that high school students and the teachers believed that using PBL to teach English communication could help the students understand the lesson easily and stimulate their interest in learning English communication. In another study, Giri (2016) aimed to reveal perceptions and practices of PBL, EFL learners' motivation and engagement in PBL in Nepal. PBL was reported as effective and helpful for developing co-operation and collaboration among the students. Additionally, as the learners are taking part in varieties of works according to the nature of projects, such projects are considered to develop 4Cs and to equip learners with both knowledge and skills to help them survive and thrive in the 21st century global context. In a more recent, parallel study, Wongdaeng and Hajihama (2018) examined the student perceptions of PBL on promoting 21st Century Skills namely, collaboration and communication and learning motivation in a Thai EFL college setting after

implementing PBL with a group of with a group of 30 grade-10 EFL learners. Findings revealed that PBL is perceived to be effective in enhancing the learner's motivation to learn English and developing the target 21st century skills. Grounded on this, PBL is found out to be appropriate for language learners and suggested to be applied in EFL classrooms as also asserted in the current study.

5.2.6 Discussion of the findings for research question 6. The sixth research question aimed to explore students' opinions on ICT-assisted PBL. To reach this goal, students' pre and post interviews, as well as their pre and post written reflections were analyzed separately. According to the semi-structured interviews, majority of the students were found out to be inexperienced with PBL and SDGs at first and haven't been participated in PBL before. However, according to the results of the post-interviews, all of the students asserted to gain knowledge and awareness on the PBL with reference to SDGs. Regarding the collaborative work, students were found to have difficulty in engaging cooperative project development at first, but get used to work in groups as suggested in their post interviews. When students' ICT and technology use were explored, students actively made use of web 2, 3, and 4 tools frequently for creating a web-site, developing a mobile app and designing an AR integrated brochure. They also pointed out that technology use facilitated PBL as it provided more permanent and time-saving learning process. When technology use in PBL was sought, the post-interviews illustrated that students became competent in using the emerging technologies for supporting and enriching their projects. When students' opinions on PBL were analyzed, it was found out that almost all of the students appreciated PBL as an effective method fostering their productive skills as well as 4Cs and underlined that it was a beneficial, innovative and enjoyable way of learning for developing their problem solution, emerging technology and research skills as well. In a similar vein, Chu, Chow, Tse and Kuhlthau (2008) examined how 141 primary school students in China improved their research skills through PBL. Students were asked to write a report and give a presentation at the end of two group projects. The analysis of the lesson plans, assignments, written reports, presentations of students, as well as surveys and interviews revealed that PBL developed students' collaborative research skills significantly.

In parallel with the findings of the semi-structured interviews, when students pre and post reflections were analyzed, majority of the students found ICT tools as practical, user-friendly, time-saving, and beneficial. PBL was also found out to be an effective method offering a challenging but permanent, enjoyable and active learning opportunity for students. On the other hand, some challenges they asserted included the time-management problems, intensive workload, and online communication and collaboration among group members in pandemic context. In terms of group work, both pre and post reflections again indicated that working in groups was generally found put to be influential for increasing 4Cs while some drawbacks including online communication problems as well as pandemic were underlined. When students' ideas on the effects of PBL on L2 writing skills were analyzed not only pre but also post reflections revealed that students had positive opinions through the impacts of PBL on their academic writing skills for enhancing their vocabulary, making use of appropriate grammatical structures, conjunctions, and spelling. In line with this, PBL was found out to be efficient for improving L2 speaking process in terms of pronunciation, fluency, and accuracy whilst decreasing their speaking anxiety. In addition, students appreciated PBL for making a progress from the first project to the third one in terms of developing their productive skills as well as their 4Cs as students emphasized the difference between their first and third projects in terms of the functionality and advance levels. Regarding the SDGs, upon completing the third projects, students were found out to become more aware, responsible, and conscious for providing solutions to these global problems.

In terms of the students' perceptions' on PBL in tertiary level, the results of the interviews and written reflections of the students were in accordance with the findings of the previous research (Adams, 2018; Avşar, 2017; Essien, 2018; Gibbes, 2011; Petersen & Nassaji, 2016; Tims, 2009), which concentrated on positive student perceptions on PBL for developing L2 language skills and language achievement of EFL learners. In addition, regarding students' opinions on PBL, in line with the findings of the current study, as suggested by Mohamad and Tamer (2021, p.96), many other studies in the literature also pointed out that "teaching and learning language via the PW approach was found to encourage a positive attitude towards language learning, language lessons, and aspects of the PBL approach". For instance, Peterson

(2004) conducted a mixed-research study to examine 33 teachers' and 88 students' perspectives and their use of PBL at two Canadian ESL schools in Victoria. The data obtained via questionnaires, interviews, and artifacts, revealed that not only the teachers but also the students had positive perspectives towards PBL. Regarding the Turkish context, Baş and Beyhan (2010) investigated the impacts of multiple intelligences supported PBL on students' achievement and attitudes towards English lessons. According to the results, the participants "who have been educated by multiple intelligences supported PBL method have been found out to have more positive attitude levels to English lessons than those who have been educated by the traditional language teaching methods" (p. 378). In the same context, Baş (2011) also highlighted that "the students who were educated by project-based learning had developed more positive attitudes towards the lesson than the students who were educated by the instruction based on student textbooks" (p. 10). In a parallel study, Yaman (2014) explored the efficacy of PBL on EFL students' attitudes towards the development of speaking skills. Following a semester of treatment period, the results indicated a statistically significant difference between the experimental and control groups. The PW group students were found to have more positive attitudes towards the course compared to the coursebook group students. Similarly, Hsu (2014, p.79) concluded that participants generally had positive attitudes toward the PBL because it provided them opportunities for active learning, enhancement of their English reading skills, and ability to use online resources. In line with these, Shin (2018, p. 108) asserted that students' perceptions on PBL were found to be very positive as the participants reported to have strong confidence in English learning through PBL process and were in favor of PBL to be integrated into their future classes. In another recent study, Kartika (2020) explored 14 students' perceptions on PBL by implementing a half-semester project in Indonesian EFL context. The participants divided into groups of three and were asked to search and present the end-products (posters). The findings of the questionnaire and the interviews demonstrated that the participants were positive about using PBL in critical reading class. Although the participants in the abovementioned studies expressed their enjoyment of their learning experiences through PBL and had overall positive attitudes on PBL, Eyring's (1997) participants were found out to be unsatisfied with the PBL experience in spite of the amount of time spent on planning, researching, and assessing project-related activities. The

findings revealed that specifically male students were not responsive to the PBL, and focus problems were monitored more in the project group compared to the control group. On the other hand, participants reported positive opinions in relation to the freedom during the project process. In line with this, Beckett (1999, p. 137) claimed that the participants indicated controversial perceptions of PBL as 25 % of students had dilemmatic feelings about projects whilst 57% of them reported PBL negatively considering that PW was not a good method to learn. These two previous studies findings revealing negative attitudes of the students on PBL also contradict with the findings of the current research as the majority of the participants found PBL as an effective method to foster their EFL learning process.

Although the impacts of PBL on students' vocabulary development wasn't at the heart of this current research, students' interviews and written reflections also highlighted the improvement of vocabulary knowledge of students after being exposed to PBL. In accordance with the results of the current research, Shafaei and Rahim (2015) found out that twenty EFL Iranian students taught using the PBL approach had better retention of new vocabulary with a higher level of difficulty compared to the ones who were taught in conventional class. In a similar vein, Reisi and Saniei (2016) highlighted that PBL significantly fostered the intermediate level of EFL students' vocabulary learning in a private high school. The pre and posttest results suggested that experimental groups significantly outperformed the participants in the control group in terms of vocabulary learning. In a parallel study, Migdad (2016) explored the impacts of the PBL on enhancing 76 third graders achievement levels in vocabulary in Gaza. The pre and post-test results revealed statistically significant differences in favor of the experimental group taught with PBL. In a more recent study, in Iranian context, Mohamadi (2018) sought whether there is a statistically significant difference in learning and retention of idiomatic expressions through PBL and e-PBL from both achievement and learner perspectives of ninety intermediate EFL students assigned into three groups: control, PBL, and E-PBL. After 15 sessions of treatment, posttests and delayed posttests revealed that PBL and E-PBL groups outperformed the control group in learning and retention whilst the PBL group outperformed E-PBL in both retention and sustainability of the knowledge. These findings supported the findings of the current study as many students emphasized that PBL process would be more

effective if the lessons could be conducted face to face and they indicated the communication problems during collaborative project creation process in relation with pandemic.

Lastly, the results of the semi-structured interviews and written reflections of the students complemented with the previous studies in the literature, which pointed out that incorporating PBL in the context of language education enhanced students' motivation in the long pace. Although students reported to have difficulties in getting used to PBL and their motivation sometimes decreased depending on the intensive program requirements, they were overall found to be highly motivated, eager and active during the 14-week implementation process. In terms of PBL as an asset to increase motivation, for instance, Gu (2002) conducted a 12-week study with twenty Chinese college students and 28 American junior college students at Suzhou University in China. The two groups, which were expected to work in groups to conduct investigations into business opportunities or cultural topics in China or America, then were asked to compose a research report to be presented orally in class in the form of web pages or PowerPoint slides. The results elicited from classroom observations, interviews, email messages, and other electronic texts revealed that students' motivation was increased after completing their projects as students reported "great enthusiasm and enjoyment" (p. 201). In line with this, Lam, Cheng and Ma (2009) investigated the intrinsic motivation of 631 students enrolled at four different secondary schools in Hong Kong while work in small PBL groups and study multidisciplinary topics under the supervision of 126 teachers. The results obtained through the submission of a written report and an oral presentation on what students have learnt at the end of the projects revealed that students' intrinsic motivation increased because of the teachers' intrinsic motivation who provided sufficient instructional support during three months of PBL activities. This finding is supported by the current research as the students found the lecturer as a supporter motivating them to complete their projects during the implementation stage. In another study conducted within two ESP classes of 25 third-year university students majoring in business at the Graduate Business School in Tunisia, Trabelsi (2013) examined the impacts of group work projects on students' motivation. The data gathered by means of questionnaires indicated "motivated feelings of a strong interest in the

communicative language use of English and their desire to break up the routine of the class” (p. 87) were also reported. Similarly, Shin (2018) examined the impacts of PBL on students’ motivation in a general English language classroom. Seventy-nine students were required to work collaboratively to produce a “resume and cover letter video” project. The results of the pre and posttest indicated that the project had a great impact on students’ motivation to learn English. However, motivational factors of attention and relevance were found to be significantly different in the pre- and posttest results, whilst confidence and satisfaction did not improve in the short term. On the other hand, the self-reported opinions obtained through written reflections and semi-structured interviews of the current study highlighted that students’ confidence, as well as their motivation increased after being exposed to PBL.

5.2.7 Discussion of the findings for research question 7. The last research question aimed to explore the opinions of the lecturer on the implementation of the ICT-Assisted PBL. The findings elicited through the field notes of the lecturer indicated that ICT-Assisted PBL was found out to be an effective methodology provided gains both for students and the lecturer as well. From students’ sides, it was beneficial for the development of productive skills, 4Cs and raising their autonomy. In addition, in lecturer’s side, PBL was highly influential for the professional development. On the other hand, duration of the program, class size, students’ level of education and the students’ limitations during the pandemic process were found out to be challenges of the PBL process. The results of the study, which indicated that upon implementing the PBL approach, students’ attitudes may change from acceptance and resistance in different phases of the project development process were in line with the results of the other previous studies in the literature. For example, while students indicated the due dates, exhausting work schedule and difficulties online communication through collaborative group work as challenges, they overall had very positive attitudes in terms of presenting their products, engaging in the problem solution process, being active participants for the development of their L2 productive skills as well as their 4Cs in the present study. In this regard, Gu’s (2002) study also pointed out the same discomfort and challenge, specifically at the beginning of the project as six of the students found the PBL process very hard. On the other hand, the other students asserted their enjoyment of cooperation and collaboration as suggested

in the current research, too. In a similar vein, Simpson (2011) considered the same negative attitudes at the beginning of the study, which was appreciated later on as students got used to it. Also, the teacher-centered approach which replaced the student-centered approach was found to be the top challenge reported by the researcher during the first stages of PBL. On the other hand, in another study, Kean and Kwe (2014) highlighted that participants “felt comfortable participating actively in the project” (p. 196) as suggested in the current study. However, similar to the findings of aforementioned studies, the field notes of the researcher, particularly, the pre interviews and written reflections of the students indicated that some of the students found the PBL process challenging at the very beginning, as they were inexperienced in working on collaborative projects via online platforms. In addition, pandemic, due dates, workload, online communication for project development were reported to make them feel exhausted. In spite of these challenges, students’ development of language skills and 4Cs, fostering their autonomy were reported as the main benefits of PBL.

5.3 Conclusion

This study promotes a local voice on the impacts of ICT-assisted PBL on whether and how students develop their productive skills as well as their 4Cs in relation to EFL learning process. In line with this, this study sheds lights on the perceptions of students’ regarding the enhancement of learner autonomy and project development self-efficacies. In addition, when this implementation was completed, the EFL students acknowledged themselves more aware of SDGs, competent in L2 productive skills, using emerging technological tools and integrating them to project creation process, effective critical thinkers, creators, collaborators, and communicators who can solve real-world problems, defining themselves as more autonomous learners who are responsible of their own learning process. In addition, it was found that they statistically improved on their L2 productive skills and 4C skills in an integrated way as well as their vocabulary, research, and presentation skills.

The present study significantly contributes to the literature by providing new information about the use of ICT-assisted PBL in higher education EFL contexts, particularly in General English and English preparatory programs. It also reveals the

nature of PBL practices and scope of the in-class and out-of-class activities implemented by the instructor. Meanwhile, it reflects the opinions of the students who participated in PBL class and reveals significant effects of ICT-assisted PBL on the development of 4C and L2 productive skills at the same time. In addition, this study presents alternative ways to integrate and assess 4Cs in EFL context, serves as a guideline to provide various sources for the systematic development and evaluation of these skills in parallel with L2 productive skills. The results showed that ICT-assisted PBL is significant for fostering L2 learners' productive skills together with 4Cs, enhancing learner autonomy, developing ICT competencies, raising awareness and knowledge on SDGs, increasing self-efficacy beliefs on the development of researching and problem solution skills, whilst shifting the teacher-centered role of the instructor to the teacher facilitator role in EFL context via facilitating the professional development, as well.

5.4 Pedagogical Implications

The current study is groundbreaking in that it is the first empirical study to adopt, implement, and evaluate ICT-assisted PBL using UNSDGs in ELT Pedagogy and suggest structured ways to integrate language education and 21st century skills implementation, development, and assessment at the same time. Although this research focused on one state university, the experiences are relevant to a wider body of literature, expertise, and practice in the field of EFL education, and can help other schools, specifically General English Programs and Preparatory Schools on the systematic ways to implement ICT-Assisted PBL within the scope of SDGs to foster L2 productive skills as well as 21st century competencies in an integrated way while encouraging students to take responsibility of their own learning process. Based on the findings of the study, ICT-assisted PBL facilitates the development of 4Cs, improves L2 productive skills, raises awareness on SDGS and global problems, enhances learner autonomy, encourages learners to produce authentic solutions to real-life problems, and develop their ICT skills, as well.

In the light of the findings of the present study and discussion, there are a number of other implications, which can be suggested to policy makers, administrators,

curriculum planners, material developers, practitioners and students as this study sheds light on the effects of PBL in ELT, evaluates its impacts, reveals students' perceptions on it, provides fellow practitioners alternative ways and available sources to apply and assess such program. Initially, the administration and practitioners should reframe students' roles in their learning process, and support them to take charge of their own learning. The students who took part in this study valued having a voice in their learning process by choosing what project themes they study, which collaborative groups they form, what strategies they follow, how to study individually and in groups, and how to demonstrate their understanding of the learning objective while presenting their project products. With this student-centered pedagogy, students freely express their opinions on their choices while raising their voice in terms of each project development phase. The present study also provided evidence for the fact that teachers play a critical and crucial role in the effectiveness of using PBL in EFL context as they have a facilitating, supporting, and guiding position through PBL activities and this affects students' engagement, willingness, and involvement during in class and out of class activities. As emphasized in the results, teachers may provide a multitude of learning chances for students who learn English in line with global content. Another implication of the current study is for decision makers and teachers is that the findings could be fruitful for providing them sources, materials and syllabus for integrating ICT-Assisted to develop 4Cs and L2 skills in an integrated way in any general English course or preparatory class. As a result, policymakers also must establish curricula and syllabi in EFL context that fosters language competency while also equipping learners with 21st century skills and encouraging them to participate as active citizens. In that sense, policymakers can use the findings of this study to assess, adjust, or analyze their curriculum or syllabus design. Other stakeholders, on the other hand, should be aware that they are critical partners in increasing the quality of this curriculum and pedagogy. This study has also considerable implications to the ELT researches. For instance, it threw up many questions that need to be sought thoroughly. As using ICT-Assisted PBL had effects on the development of L2 productive skills and 4Cs, further studies could investigate the impacts of PBL on the receptive language skills as well. Finally, the suggestions for material developers and course book writers include the fact that integrating globally relevant topics and emerging technological tools into textbooks and supplementary materials in accordance with a PBL focused curricula could be

useful for EFL teachers to implement and assess L2 and 21st century skills in an interwoven way.

5.5 Recommendations for Future Research

The present study provides valuable information about the nature of PBL implementation in higher education EFL classrooms, the students' and instructor's opinions about PBL, and the effects of ICT-assisted PBL on students' L2 productive skills, 4C skills, PBL self-efficacy beliefs, and perceived levels of learner autonomy. Regarding the research findings and limitations, the areas stated below can be considered in future PBL research. Firstly, this study was conducted in a General English program in a state university through the participation of strongly motivated, highly eager, volunteer students, and an instructor. Conducting similar studies in General English or preparatory programs in state, private, and foundation universities with a bigger number of participants may reveal more information about the applicability of PBL in higher education EFL classrooms. In addition, carefully and systematically planned longitudinal through-experimental studies investigating the effects of PBL on students' achievement in both productive and receptive EFL skills as well as other 21st century skills within English preparatory programs may also greatly contribute to the field.

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APPENDICES