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Implementation of technology-enhanced project-based learning to improve university students' English ability: A systematic literature review

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Abstract

This study aims to analyze the implementation, effects, and challenges of technology-enhanced project-based learning (PBL) in improving university students' English language proficiency while also exploring the connection between technology-enhanced PBL and students' English learning outcomes. Using a qualitative systematic literature review method, the study synthesizes findings from 31 national and international peer-reviewed articles published between 2019 and 2023, obtained from Scopus, Google Scholar, and Semantic Scholar. The results show that a variety of digital platforms and tools were used to support project-based English learning in higher education settings. The implementation of technology-enhanced PBL significantly improved students' English proficiency and soft skills, such as communication, collaboration, and critical thinking. However, several challenges emerged, including group conflicts, time management issues, technical difficulties, and limited internet access. Despite these obstacles, the study confirms a clear positive relationship between technology-enhanced PBL and the development of students' English abilities. Given the limited availability of systematic literature reviews on this topic, the present research provides valuable insights into the global application of technology-enhanced PBL for improving English language education in higher education contexts.

Keywords: English ability, Project based learning, Systematic literature review, Technology-enhanced.

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1. Introduction

The integration of Information and Communication Technologies (ICT) in the teaching and learning process has been enhancing the quality of the education system in the world [1]. Technology integrated into model

learning implementation has become increasingly well-known since the COVID-19 pandemic outbreak. The integration of technology in teaching and learning English creates a unique learning atmosphere that benefits instructors and students [2]. The advancement of technology is one of the variables that may support and increase educational quality while also assisting teachers and students in the learning process [3]. Furthermore, the implementation of technology in the teaching and learning process is still prevalent in the post-pandemic era, as it encourages educators to integrate technology in teaching and learning processes to produce human resources with great employability and skills to compete in business and industry after graduating [4, 5]. Additionally, it aligns with the objectives of the 21st century, such as communication, collaboration, critical thinking, and problem-solving skills [3]. This means that higher education institutions should prepare their students by providing appropriate teaching and learning processes that are enhanced by technology in order to hone students' knowledge, soft skills, and digital literacy, especially in English courses.

In the revolution of Industry 4.0, employers need academic achievement, English skills, and soft skills to be hired by the business industry [6, 7]. Consequently, instructors are compelled to adjust and discover innovative teaching and learning techniques to be applied during the learning process, allowing students to acquire both academic and soft skills [8, 9]. Therefore, universities should implement learning methods that integrate technology and align with students' demands. Critical thinking and creativity are needed for a person to solve issues, while teamwork and communication skills are required for them to engage and cooperate with others. The world of education must prepare the future generation to keep up with trends and even become agents in the next expansion process.

One approach that can be implemented in teaching and learning English as a foreign language (hereinafter; EFL) in line with the curriculum and 21st-century education is PBL. It provides autonomous learning experiences to improve students' engagement, creativity, and technological mastery. The comprehensive method of PBL involves learning through collaborative project work and utilizes actual experiences, which has proven to achieve academic and soft skills [9]. The fundamental aspect of this method is to assert the skills of students in dealing with problems encountered in their real life [10]. Many disciplines have implemented PBL in school settings as a method for students to acquire specific topics by simulating real-life conditions and motivating them to investigate, solve problems, or make decisions [9, 11]. In summary, PBL blends what students already know and do in learning [12] wherein students employ their background knowledge to create a vital endeavor rather than merely taking paper tests or being evaluated according to written examinations.

Furthermore, the advancement of technology and its application also enriches the use of PBL, as Project-Based Online Learning (PBOL) is the technique that offers several benefits over other methods, particularly in terms of assisting lecturers and students to interact anytime and anywhere, as well as enabling students to obtain instructional materials for lectures [10]. Previous instructors have implemented methods of instruction and learning that combine digital technology with a learning model to improve students' English skills; one of these methods is PBL. First, research conducted by Qisthi and Arifani [13] used social media, namely Instagram, to improve the speaking ability of secondary school students through PBL. The findings presented that Instagram could significantly improve students' speaking ability [13]. Second, Yang, et al. [14] applied digital storytelling to enhance secondary school students' speaking skills. This study revealed that digital storytelling integrated with PBL is effective in fostering students' speaking skills and creative thinking [14]. Next, Suhroh, et al. [15] applied whiteboard animation in PBL to enhance vocational high school students' English speaking skills. This study found that the implementation of whiteboard animation in PBL significantly improved students' English presentation skills. Additionally, using the Muzivu application to promote university students' learning of English through the integration of ICT showed that PBL through the Muzivu application can improve students' intrinsic and extrinsic motivation [16].

Based on the previous description, many researchers have explored the application of technology-enhanced PBL in English teaching and learning activities at secondary and senior high schools, particularly in enhancing students' speaking and writing abilities. Nevertheless, the dearth of studies in accordance with the utilization of PBL integrated with technology at the tertiary education level, particularly in systematic literature reviews, is still limited. Therefore, this study was conducted to address this research gap. The research questions of this study are as follows: (1) How is the implementation of digital technology-enhanced project-based learning in English learning, and what are its benefits? (2) What are the effects of technology-enhanced PBL on students' English learning? (3) What challenges do students experience in English learning through technology-enhanced PBL? (4) What is the network and connection visualization of the keywords in the included articles? Therefore, this study aimed to examine the implementation, effects, and challenges of technology-enhanced PBL in improving university students' English ability and explore the connection between it and students' English ability.

2. Literature Review

PBL in EFL can be described as a student-centered method in which students perform real-life tasks and complete projects. It promotes students to study in a multifaceted way, allowing them to take responsibility for what they are learning in a collaborative setting [17, 18]. It is acknowledged as a holistic approach to language teaching because it fosters integrated language skills and equips learners to communicate effectively across various contexts [19, 20]. The implementation of PBL is rooted in constructivist learning theory, focusing on

student-centered learning and authentic learning [21]. Constructivism assumes that students must explore their knowledge in line with the activities and outcomes of PBL [21]. Constructivism holds that learners construct novel information based on previous learning and experiences [20, 22]. Thus, PBL is considered an innovative way of learning to boost students' 21st-century abilities [23]. The student is at the center of learning, and the role of the teacher is to act as a facilitator in an instructional interaction tailored toward groups of students comprised of a limited number of diverse individuals [22]. In addition, it is emphasized that the learning process in university must implement PBL to respond to the demands and developments of today's generation based on noble national values. In short, PBL is an effective approach to enhancing students' knowledge and 21st-century skills that align with educational needs.

Furthermore, PBL implies a holistic teaching method in which student learning settings are constructed; therefore, students may investigate real-world issues, such as strengthening subject knowledge and completing other significant activities that encourage pupils to work autonomously in creating tangible products [24]. Authentic or real-life implementation is the core of PBL. Project work involves processing information from many sources, using real-life activities, and integrating competencies. Real-world problems and subjects of genuine interest become fundamental to class project work [25]. Written works, paintings, movies, photos, or technological support presentations are examples of products from project work [26]. Engagement with the actual world can provide the foundation for authentic linguistic input from the outside world of real facts, as well as encourage personal interest and involvement in the activity. Learners acquire motivation, language skills, group function, self-esteem, independence, cooperative skills, and problem-solving skills in PBL [27]. In short, PBL has the power to assist students in having a more engaging and meaningful experience while learning.

PBL is recognized for its potential to promote social and emotional development in addition to assisting students in acquiring a greater understanding of their education, as it can strengthen students' metacognition, English, and soft skills [21, 28]. The activities during PBL, namely preparation, information gathering, information processing, presentation, and reflection, can improve students' language skills, achievements, and soft skills [29]. It also enhances students' confidence, motivation, independence, and creativity. In teaching and learning English through PBL, students improve their English and soft skills, which are crucial aspects of job competency in the real world.

It is clear that ICT has made a substantial contribution to project accomplishments by providing the required equipment [2]. The Internet is frequently quite useful in implementing the technology-enhanced PBL concept, as web technology and applications allow for the creation and sharing of projects that reflect real-life circumstances [26]. The implementation of PBL in an online setting has been increasing, especially in teaching and learning EFL during the pandemic [21]. PBL, through technology integration, improves students' engagement with learning, as it provides effective interaction among learners in accomplishing their projects. Furthermore, the implementation of PBL online offers several benefits; namely, it facilitates communication between lecturers and students from anywhere and anytime, as students can obtain lecture materials via platforms or LMS through smartphones, computers, and tablets [10]. This means that technology-enhanced PBL supports ubiquitous learning that matches students' needs and lifestyles in this era.

Technology-enhanced PBL, combined with digital classroom facilities, allows students to obtain varied learning experiences that are congruent with their requirements [30, 31]. Digital technology is widely recognized, as it is now a part of everyday life in society. It involves the ability to use technology via devices and gadgets such as computers, mobile phones, and tablets to access social media or cyberspace for specific objectives such as communication or cooperation [32]. With greater integration of technology in classrooms, learning has become considerably more effective, as it aligns with 21st-century education, in which students actively participate in enhancing their knowledge [33]. Through ICT in learning, students are expected to maintain communication and interaction with peers and teachers. In other words, integrating digital technology into PBL procedures can enhance teaching and learning activities, especially in English learning.

PBL encourages students to learn by utilizing language to acquire foreign language skills and knowledge [34]. They also assert that using technology for project work is an intuitive development in an educational setting, as students can use wikis, blogs, websites, LMS, and social media in PBL. The use of ICT in teaching activities can inspire novel teaching techniques and student-centered practices in education [35]. Integrating technology in PBL positively affects educational institutions, leading to increased students' digital literacy, motivation, engagement, independent learning, cooperative learning, higher-order thinking, and critical thinking skills [35].

In addition, the implementation of technology-enhanced PBL in English learning has been increasing since the COVID-19 pandemic and continues post-pandemic due to its convenience and novelty, especially for the millennial, Gen Z, and Gen Alpha generations [36]. Moreover, the pandemic resulted in a digitized educational setting. Andersson & Jungerth point out that it was more challenging to construct projects via fully technology-integrated PBL throughout the pandemic, but there were significant results in online PBL compared to other methods [37]. Digital projects or virtual work have further elevated and become a new trend amid the pandemic, as communicating with peers and accomplishing projects were conducted using technology [38]. Therefore, it can be concluded that technology-enhanced PBL is effective for implementation in the English teaching and learning process during and after the pandemic.

3. Methods

The study utilized library research to explore literatures on journal databases. This study employed systematic literature review (SLR) approach in analyzing the articles. The guidelines of PRISMA were adapted to perform the study which implementing several stages namely identification, screening, eligibility, and synthesize [39, 40]. Next, the accepted articles were analyzed through narrative synthesis [41] in order to answer the research questions namely how the implementation, effects and challenges of technology-enhanced PBL in improving university students' English ability. Furthermore, the researchers conducted Bibliometric analysis through VOSviewer 1.6.20 version to investigate the network and connection visualization among the keywords of the reviewed articles. The literature review stages were presented in Figure 1.

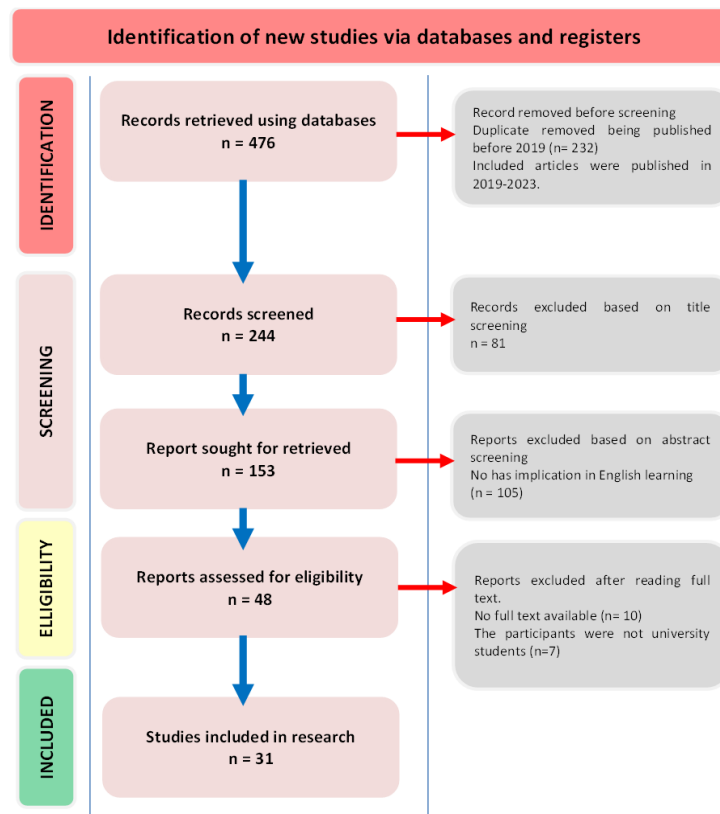


Figure 1.
PRISMA flowchart illustrating the systematic review process.

3.1. Identification (Searching)

The researcher searched articles that relevant to the study from online databases and article search engines namely Harzing's Publish or Perish (POP) through Scopus, Google Scholar, and Semantic Scholar that published from the past five years (2019-2023). The keywords typed by the researchers were 'project based learning', 'project based learning in English learning', 'technology-enhanced project based learning', 'online project based learning', and 'effect of project based learning'. In this stage, the researcher obtained 476 articles, but researchers eliminated 232 articles since the year of publications were before 2019 and the articles only can be accessed by using membership. The inclusion and exclusion criteria of the literatures were presented in Table 1.

Table 1.

The inclusion and exclusion criteria of articles.

No.	Inclusion criteria	Exclusion criteria
1	The articles, proceeding and thesis that interrelated to the research questions namely technology-enhanced PBL.	They are books or personal point of view from blogs.
2	The Articles were published during 2019-2023	The articles were published before 2019.
3	The research subjects were university or college students.	The research subject were elementary, secondary and high school students.
4	The articles could be accessed freely.	They are not free access and only accessed by the member.
5	The teaching approach was technology-enhanced PBL.	The teaching approach was not technology-enhanced PBL.
6	The technology-enhanced PBL was implemented in English learning context.	The technology-enhanced PBL was not implemented in English learning context.

3.2. Screening

To examine the inclusion and exclusion papers, the researcher studied the titles and abstracts of the publications. In this stage, the researcher would retain the articles associated with the research questions and discard the rejected articles that were irrelevant to the study. In the initial screening, 81 articles were removed since the titles were not relevant with the study or did not explore about technology-enhanced PBL in English learning. After reading the abstract of the articles, in the final screening the researchers had retrieved 153 publications.

3.3. Eligibility

The researchers manually reviewed the remaining publications to evaluate if the papers met the inclusion criteria. One hundred five articles were deleted after reviewing the title, abstract, and content because they were irrelevant to the study subject. The total number of articles in this stage was 48 since 17 articles did not have full text and the subjects of the studies were not university students. Thus, the researchers removed 17 articles.

3.4. Synthesize and results

In this stage, 31 articles were relevant to the study topics and met the inclusion criteria. The accepted articles were analyzed through narrative synthesis by grouping or clustering the data and making tabulation based on the research questions to convey the data graphically to assist the researchers in synthesizing the reviewed articles [41]. Therefore, in this stage, the researchers studied the accepted articles in depth to answer the research questions.

4. Results

The focus of this study is to acquire how the previous researchers have implemented technology-enhanced PBL in English learning at higher education level. The following research questions in Table 2 are driving this study.

Table 2.

The research questions of study

Code	Research Questions	Objectives
RQ1	How the implementation and what are the benefits of digital technology-enhanced project based learning in English learning?	Analyze how to implement technology utilized in PBL into the process of learning and the benefits of them.
RQ2	What are the effects of digital technology-enhanced PBL on students' English learning?	Analyze the various forms of technology utilized in PBL and the effects of them on students' English learning.
RQ3	What are the challenges experienced by the students in English learning through technology-enhanced PBL?	Identify the challenges or problems experienced by the students in English learning through technology-enhanced PBL.
RQ4	How the network and connection visualization of the keywords in the inclusion articles?	Identify the network and connection visualization of the keywords in the inclusion articles.

In this study, the researchers synthesized 31 articles that match the study's criteria. All the articles discussed the implementation of technology-enhanced PBL in English learning at higher education level and published during 2019-2023. After reviewing the articles, the data were summarized to guide them in answering the research questions and to discuss the findings obtained in the selected articles. Table 3 contains the summary of the selected articles.

Table 3.

The Summary of Selected Articles in 2019-2023.

No.	Authors	Aim of the Studies	Method of Studies	Technology forms	Findings	Year	Countries
1	Sa'diyah and Cahyono [42]	To examine the influence of PBL through blogging on English department students' writing ability.	Quasi experimental	Blog	PBL through blogging can improve English department students' writing ability.	2019	Indonesia
2	Al-Munawwarah, et al. [43]	To explore the implementation of PBL through digital short story in learning critical English reading of university students.	Descriptive	Video	PBL through digital short story could improve critical English reading of university students.	2020	Indonesia
3	Lubis, et al. [44]	To investigate English department students' communication skill through the integration of PBL and digital media.	Experimental	Video, Youtube and Telegram	The integration of digital media could improve English department students' communication skill	2020	Indonesia
4	Mafruudloh and Fitriati [45]	To explore PBL implementation and to determine the effect of PBL on Management department students' speaking ability.	Pre-experimental	Video and social media.	PBL through the use video and social media was effective in increasing Management department students' speaking ability.	2020	Indonesia
5	Mohamed [46]	To examine PBL implementation in the ESP through Muvizu application that promotes students' motivation.	Descriptive quantitative	Muzivu application	The implementation of PBL through Muzivu application could improve students' motivation.	2020	Indonesia
6	Phu-ngamthong [47]	To investigate the effect of PBL on university students' speaking skill and their opinions towards PBL drama.	Pre-experimental	Video and Google Classroom	The implementation of PBL through video and Google Classroom could improve students' speaking ability and they have positive attitude towards the learning process.	2020	Thailand
7	Sholikhah [48]	To explore university students' learning outcome in speaking class through PBL implementation.	Classroom Action Research	Vlog video and Youtube	There was improvement on students' speaking learning outcomes through technology integrated PBL.	2020	Indonesia
8	Yamil [12]	To examine the effectiveness of PBL on English department students' critical reading skills and its connection to 21st century skills.	Experimental	Storyboard application	PBL through storyboard application was effective in improving students' critical reading skills.	2020	Thailand
9	Baron [49]	To determine the implementation of PBL through video project in improving English department students' speaking ability.	Pre-experimental	Video and Zoom	PBL through video project could improve English department students' speaking ability.	2021	Indonesia
10	Ibrahim, et al. [50]	To examine English communication skills development after implementing PBL through Massive Open Online Courses (MOOC).	Quasi-experimental	Massive Open Online Courses (MOOC)	The use of MOOC in PBL could enhance the students' communication skills.	2021	Malaysia
11	Hoesny and	To investigate the implementation of PBL	Case study	Video, Youtube,	The implementation of PBL through	2021	Indonesia

	Ratnawati [51]	through Youtube to improve students' speaking ability.		and Zoom.	Youtube could improve students' speaking ability.		
12	Poonpon [52]	To explore participants' perception toward OPBL during pandemic.	Qualitative approach	Video	Students' have positive perception related to the implementation OPBL during pandemic.	2021	Thailand
13	Rozal, et al. [53]	To determine the effectiveness of PBL through YouTube presentations on university students' English achievements.	Quasi experimental	Video and Youtube.	Youtube presentation in PBL was effective in improving students' English achievements.	2021	Indonesia
14	Suhroh, et al. [15]	To investigate whether PBL through Zoom could improve students' ability in ESP.	Classroom Action Research	Zoom	The use of Zoom in PBL could improve students' ability in ESP.	2021	Indonesia
15	Suwandi [54]	To improve students' writing skills through conducting PBL integrated with WhatsApp application.	Classroom Action Research	Whatsapp	The use of Whatsapp in PBL could improve students' writing skills.	2021	Indonesia
16	Abdulkadir, et al. [33]	To explore the implementation of PBL and process writing to improve students' academic writing.	Case study	Multimedia and websites	The implementation of PBL could improve students' academic writing.	2022	Malaysia
17	Fitriani, et al. [55]	To determine whether PBL as through the use of Edlink Sevima Application in improving academic writing skills of students majoring in English department.	Classroom Action Research	Edlink Sevima application	The use of Edlink Sevima application in PBL could improve students' writing skills.	2022	Indonesia
18	Garib [56]	To examine the perception of participants towards the implementation of technology-integrated PBL.	Phenomenological study	Video, Zoom, social media.	Students have positive attitude towards the implementation of technology-integrated PBL.	2022	United States
19	Habibi, et al. [57]	To examine students' perception of the correlation between instructor performance, online PBL, and English achievement.	Descriptive qualitative	Video and Quizziz	Instructors' performance and OPBL influenced the students' English achievements.	2022	Indonesia
20	Ilham [58]	To examine the effectiveness of PBL to improve the students' writing ability and to explore their opinion of students in English department.	Mixed method	Canva and Instagram	The implementation of PBL through technology was effective to improve students' writing ability and they have positive perception towards technology-enhanced PBL.	2022	Indonesia
21	Milad [59]	To examine university students' writing ability after implementing PBL through CALL.	Experimental	LMS	The implementation of CALL PBL could enhance students' writing ability.	2022	Kuwait
22	Tuyen and Mai [60]	To determine the challenges encountered by students, the influence of PBL implemented in teaching speaking skills and their attitudes of the implementation of PBL through LMS.	Mixed method	LMS	The distance learners have problems during online class and the implementation of PBL through LMS could solve their problems and improve their speaking ability.	2022	Vietnam

23	Tyas and Fitriani [61]	To determine the effect of making video tutorial to enhance students' speaking ability and to explore the attitude of the Informatics students toward PBL.	Mixed-Method	Video	Video presentation in PBL was effective in enhancing students' speaking ability.	2022	Indonesia
24	Villalba [62]	To examine the utilization of blogging in PBL to improve students' writing ability.	Experimental	Blog	The use of blogging in PBL could increase the students' writing ability.	2022	Spain
25	Wahyudi [63]	To examine the effect of using video through PBL on students' English skill.	Pre-experimental	Video	The implementation of PBL through video presentation was effective to enhance students' English skills.	2022	Indonesia
26	Yang and Harijanto [64]	To investigate the effect of PBL on students' self-learning and self-efficacy level.	Quasi experimental	Websites	The use of PBL integrated to technology has influence the students' self-learning and self-efficacy level.	2022	Taiwan
27	Al-Bahadli, et al. [65]	To determine the effect of online PBL to EFL students' communication, motivation and academic achievement	Descriptive quantitative	Video and Powerpoint	Online PBL significantly impact the students' English communication, motivation and achievement.	2023	Czech
28	Bakeer, et al. [66]	To examine the influence of PBL in improving undergraduate students' speaking ability through M-Learning.	Case study	Video and Whatsapp.	PBL through M-Learning influenced students' speaking ability.	2023	Palestine
29	Hidayati, et al. [67]	To explore the effect of PBL in ESP class in enhancing students' learning outcomes through instructional video.	Pre-Experimental	Video	The integration of instructional video in PBL was effective in enhancing students' English learning outcomes.	2023	Indonesia
30	Mohamed [46]	To examine the implementation of PBL to improve students' English skills and soft skills.	Case study	Video	The implementation of PBL through video improves students' English skills and soft skills.	2023	Saudi Arabia
31	Solihin, et al. [68]	To examine PBL implementation in improving students' writing skill through HelloTalk application and to ascertain students' perception toward PBL.	Descriptive qualitative	HelloTalk application	HelloTalk application in PBL could improve students' writing skill.	2023	Indonesia

Next, the articles were classified based on the method of studies namely experimental, quasi-experimental, pre-experimental, classroom action research, case study, qualitative, quantitative, mixed method, and phehomenological study. According to the finding, the majority of the studies employed pre-experimental study and the least employed phenomenological study related to the implementation of technology-enhanced PBL. The description can be shown in Figure 2.

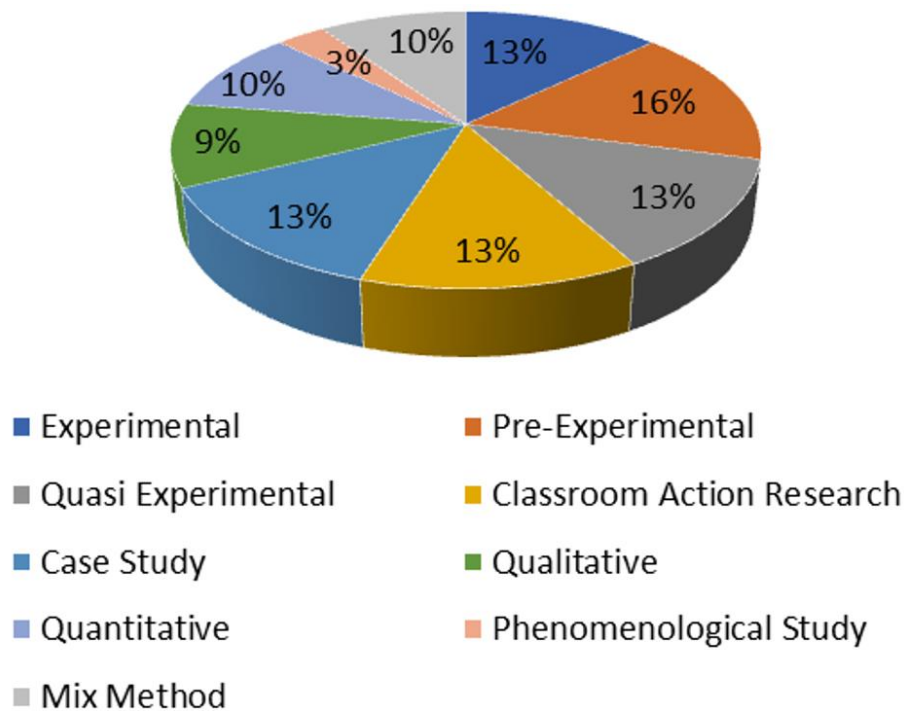


Figure 2.
The Description of the Method of Studies.

Furthermore, the researchers classified the focus of the studies in the reviewed articles to assist them in synthesizing the articles and answering the research questions, namely the implementation and benefits of digital technology-enhanced PBL on university students' English learning. The findings concluded that the previous researchers implemented technology-enhanced PBL to improve students' English and soft skills. The majority of them employed technology-enhanced PBL to improve students' speaking skills. Next, several of them also employed it to improve students' reading skills, writing skills, motivation, self-learning, and self-efficacy. Then, they also explored the students' perception after implementing technology-enhanced PBL in English learning. The findings can be seen in Table 4.

Table 4.
Distribution of Reviewed Articles' Focus of Studies.

No.	Focus of the Study	Authors
1	Reading	Al-Munawwarah, et al. [43] and Yamil [12]
2	Speaking	Lubis, et al. [44]; Mafruudloh and Fitriati [45]; Phu-ngamthong [47]; Baron [49]; Ibrahim, et al. [50]; Hoesny and Ratnawati [51]; Rozal, et al. [53]; Tuyen and Mai [60]; Tyas and Fitriani [61]; Wahyudi [63]; Al-Bahadli, et al. [65]; Bakeer, et al. [66]; Hidayati, et al. [67] and Mohamed [46]
3	Writing	Sa'diyah and Cahyono [42]; Suhroh, et al. [15]; Suwandi [54]; Abdulkadir, et al. [33]; Fitriani, et al. [55]; Ilham [58]; Milad [59]; Villalba [62] and Solihin, et al. [68]
4	Motivation	Muhammad [16]
5	Perception	Poonpon [52]; Ilham [58]; Garib [56]; Habibi, et al. [57] and Solihin, et al. [68]
6	Self-learning and self-efficacy	Yang and Harijanto [64]

Afterward, the researchers classified the technology platforms employed by the previous researchers to enhance the process of PBL. The researcher conducted this stage to answer the research question, namely, the effect of technology-enhanced PBL on improving university students' English ability. Based on the findings, it was found that the majority of technology platforms employed in PBL was through the use video. There were also several platforms used by the previous researchers in English PBL namely Youtube, Blog, Social Media, Telegram, Google Classroom, Whatsapp, Zoom and so on. The description is presented in Figure 3.

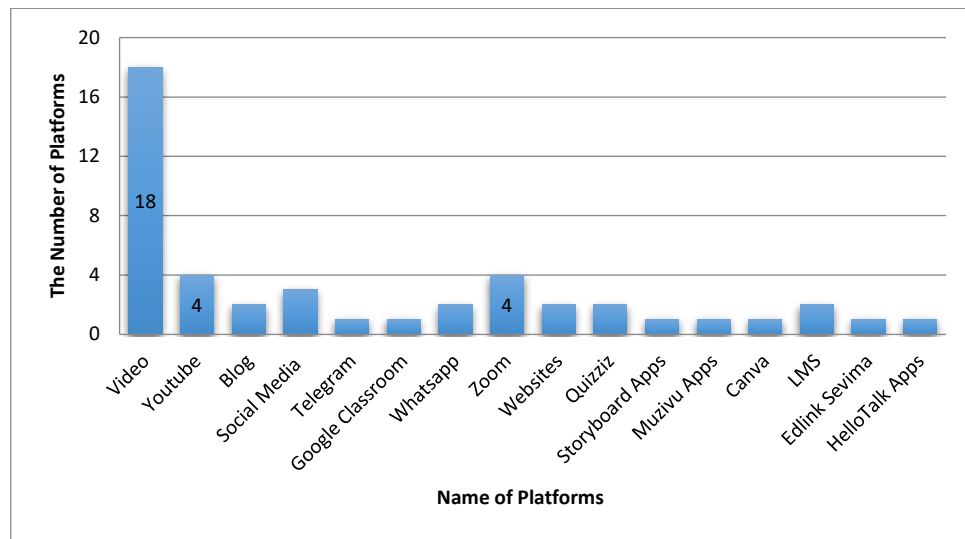


Figure 3.
The Distribution of Technology-Enhanced Platforms.

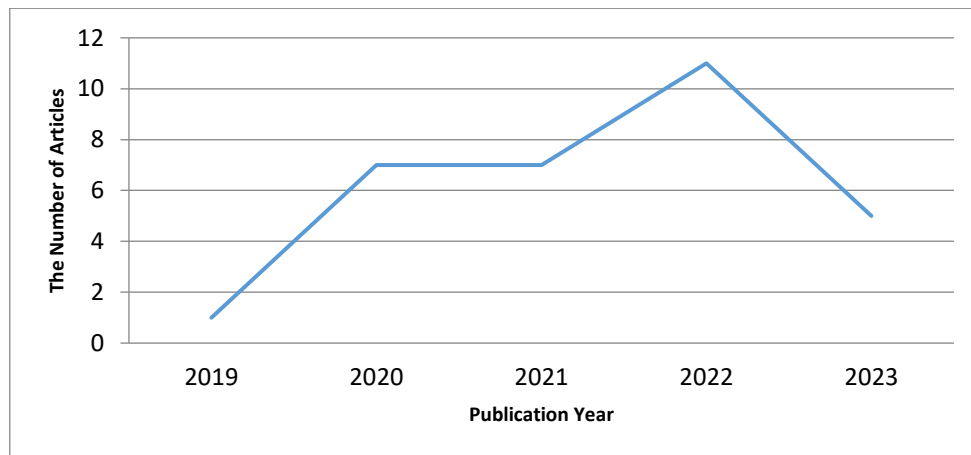


Figure 4.
The Number of Articles Reviewed in 2019-2023.

Figure 4 describes the number of studies related to the implementation of technology-enhanced PBL is increased in 2020 or during COVID-19 pandemic since the teaching and learning activities were shifted to fully online learning. The implementation of technology-enhanced PBL is still continuing after pandemic as blended learning.

5. Discussion

5.1. The Implementation and Benefits of Technology-Enhanced PBL on University Students' English Learning.

In the digital transformation era, communication skill in English has become a crucial skill for EFL students to master since it is one of the 21st century learning goals that associated with creativity, cooperation, self-confidence, and critical thinking [44]. To comply with the requirements of the 21st-century employment market, learners must be able to communicate effectively. Mastering communication skills may help students tackle professional obstacles after graduation. The capacity to speak and write clearly is defined as communication [66, 68]. An effective speaker is someone who speaks appropriately yet maintains an eye on the audience, employing a wide vocabulary and speaking to satisfy the demands of the listener. Likewise, a good writer should be able to express his or her ideas and thoughts to readers in various types of styles and ways via written words [58, 60, 61]. Students must be able to listen attentively, write accurately, and speak effectively in all settings. As consequently, proficient reading, writing, speaking, and listening skills are required are required for effective communication [50].

The advancement of technology, particularly in the fourth industrial revolution era, results in a number of developments. One example is the incorporation of technology into teaching and learning activities. The significant instrument for improving learning and assisting teachers in enriching their teaching learning activities is technology integration. In order to keep up with the proliferation of technology, the quality of instructors should also be upgraded [51]. Besides, the key responsibility of teaching is to actively involve students in the process of learning and encourage them to study autonomously. It means that giving them the opportunity to investigate their ability to identify, analyze, and apply the information students acquire in a certain course that pertains to their learning objectives. One method is to create a virtual learning environment that students may use outside of the classroom. A variety of tools might be employed in a mixed

learning environment [47]. Today's educational landscape has changed for the better or for the worse in light of the utilization of digital technologies in education. Students may more active in using computers and other media while working with digital tools namely Youtube, blogs, and social media enable learners to create material, collaborate with others, evaluate each other's work through Youtube, Whatsapp, social media, LMS, MOOC and another platforms [44, 45, 55, 59]. It is simple to adopt instructional techniques like gamification or approaches like flipped classrooms to boost learning through digital technology [50].

PBL is a student-centred method concern on the end-product. It has been stated that it promotes language teaching and learning by providing an authentic and relevant learning setting for improving language abilities, particularly speaking skills. There are prominent benefits of the implementation of digital technology-integrated PBL in English learning [44, 45, 47]. First, it enhanced students' language skills since students communicate meaningfully in order to perform real activities [46, 53]. They have the chance in practicing language in an authentic environment; and participating in beneficial endeavours that need the use of practical language [65]. Authentic activities are ones that are intended to enhance students' critical thinking and problem-solving abilities outside of the classroom, as well as learning to learn. Second, students obtain metacognitive skills through PBL which is defined as an activity involving a variety of individual or collaborative tasks, such as creating a research plan, making questions and conducting the plan included collecting, analysing, and reporting it in written or spoken form [42, 49]. Third, when students collaboratively accomplish assignment, they build their confident and autonomy [32, 59]. Furthermore, EFL students' self-confidence is the primary engine in communication skill since students who have greater self-confidence are capable of dealing with communication willingness. Project work comprises collaboration, problem solving, negotiation, and other interpersonal skills that students realize as crucial skill for a successful life [43, 68]. Then, PBL facilitate students to improve their presentation abilities and minimizes communication anxiety. Fourth, PBL delivers contextual and relevant learning for students that engage and motivate learners to participate actively in their classes. Fifth, PBL promotes social learning, which can assist students in improving their collaboration abilities [32, 47, 51, 67]. In summary, the process that leads to the final outcome of project work allows students to gain confidence and self-reliance. Students' autonomous learning is increased significantly when they are involved in project planning, such as when they select the themes for their projects. Another commonly claimed benefit is that students improve their social and cooperative abilities, as well as their group cohesion.

5.2. The Effect of the use of Digital Technology-Enhanced PBL in Improving University Students' English Ability

Based on the aforementioned articles reviewed by the researchers, it was found that the majority of the previous researchers have implemented technology-enhanced PBL to improve students' English ability, namely speaking, writing, and reading. However, every article has different research objectives and designs, such as true-experimental, quasi-experimental, pre-experimental, mixed method, classroom action research, case study, and descriptive study. In terms of speaking skills, the majority of the reviewed articles discussed the effect of technology-integrated PBL in improving students' speaking ability at higher education [44, 47, 50, 60, 61, 63].

Furthermore, the previous researchers implemented various digital technologies to conduct the teaching and learning process through PBL. The study conducted by several researchers [46, 60, 61] they implemented a video project to improve students' speaking skills. The findings revealed that PBL integration with technology through video had a significant influence on the students' speaking skills. This was due to the fact that the actual materials used were included in the phases of the exercises itself. They claimed that video PBL is one of the most effective techniques for teaching since students may hone their public speaking skills, confidence, teamwork, and creativity. Students may film their videos several of times to achieve the greatest results. It allows them to enhance their speaking ability and pronunciation. Besides, speaking in front of the camera while filming is also beneficial for increasing pupils' confidence and motivation [52, 57]. In short, video presentations in PBL could enhance the student's speaking skill and soft skills.

Afterwards, the previous researchers also used another applications and platform in presenting their students' project namely Whatsapp [66], Zoom [49], Google Classroom [47]. Whatsapp to facilitate the students' video project and discussion during COVID-19 pandemic [66]. The results showed the efficacy of using PBL experience in online discussion enhancing students' self-confidence through active participation in authentic situations. According to data finding, it was found that PBL was an effective approach that gave students further possibilities to work independently, practice English outside of the classroom, and build self-confidence. Furthermore, most students have good attitudes on utilizing social media and platforms to interact with friends and receive feedback in order to effectively finish the tasks [52, 56]. They also mentioned the student-centred approach allowed them more flexibility and responsibility to concentrate on improving their language abilities on their own pace. In addition, the study conducted by Baron [49] also presented that PBL through video project could improve students' speaking skill and Zoom could facilitate communication skill of the students during pandemic. In addition, the implementation of PBL by using Google Classroom is beneficial at teaching English speaking skills and boosting students' speaking ability [47]. It is clear that speaking talents increased dramatically. In English lessons, Google Classroom can be utilized in place of conventional classroom activities [47]. It means that, the usage of Google Classroom has a significant impact on students' ability to communicate in English.

Thus, several findings of the reviewed articles reported the use of Youtube, Telegram and other social media in presenting the students' video project [44, 45, 48, 51, 53]. The previous researchers found that the implementation of PBL by vlogging via Youtube could increase their speaking skill and motivation. The students also improve their critical thinking by respecting their friends' opinion, solving problems, and time management. The implementation of PBL integrating with technology, students improved not just speaking abilities, but also certain soft skills as they participated in

the project's completion. Some interpersonal qualities listed here were teamwork, creativity, communication, and knowledge of digital technology products. There were non-academic skill obtained by the students in learning through technology-integrated PBL, as following: (1) Enhance students' team-working skill in accomplishing the project since they share works and responsibilities, assigning specific tasks and roles to group members to enable them to complete the project, (2) Enhance students' communication skill since they had to create an effective communication pattern with the members of their team in order to accomplish the project, (3) Enhance students' creativity and ability in using digital technology since they should create and edit the video project by using applications. This skill also could manage their stress and to execute the product of digital technology. Next, PBL with the integration of digital media namely Youtube and Telegram enhance students' critical thinking and speaking skill [44]. The combination of PBL and the digital technology introduces notion to the setting of language learning. Finally, PBL and digital media are a powerful combination in the Indonesian EFL setting for increasing students' self-confidence and communication skills [52, 64]. There was significant effect of the PBL by using video and social media on students' speaking skill [64]. This result is accordance with Rozal et al. study that implemented project based learning through video presentation via Youtube affected significantly on students' speaking skill [53]. Then, the implementation of Massive Open Online Courses (MOOC) and Learning Management System (LMS) also effective in improving students' speaking ability through PBL [50, 60]. The students had achieved better communication skills after learning through PBL and MOOC [50]. In addition, the students could better improve their speaking skill, and they were pleased with the created project on LMS for its advantage in assisting students to organize their own learning environments [60].

Writing is crucial to a student's academic achievement at higher education. Writing is a productive ability that results in written output in learning activity. In terms of writing, the previous researchers used several digital platforms and applications in teaching writing through PBL. First, implemented blogging project to improved students' writing abilities [42, 62]. The findings of this research enable English instructors to create more fascinating and dynamic classroom activities for teaching writing by combining PBL through digital namely blogging platform [42, 62]. This method was effective in improving students' writing ability. Second, Suwandi [54] discovered that PBL combined with WhatsApp is an excellent technique for improving students' writing ability. The learning model facilitates students to study individually and also cooperate with their peers in practical tasks. This is done to assist government initiatives to strengthen national character characteristics like independence, confidence, hard effort, creativity, and the ability to collaborate. According to the findings of this research, PBL approach may be viewed as a method of building a learning atmosphere that encourages students to learn and grow on their own. This is due to the following characteristics of PBL: (a) students as decision-makers and creators, (b) students as process creators, (c) students as collector and organize the information acquired, (d) students as evaluator, (e) students as analysts, (f) students as presenters of their products, and (g) students as assessor. Third, students' academic writing abilities can be enhanced using the Sevima Edlink application's through PBL learning technique [55]. Students carried out the actions in the PBL method utilizing the Sevima Edlink education software with enthusiasm and motivation in each session since could be performed at anytime and anywhere. Discussion forums, projects, information, events, and surveys are among the elements of this program that allow communication among lecturers and students [55]. Furthermore, those researchers use the application's private chat function to communicate individually with students in order to encourage students to engage in learning activities.

Next, the learning activity in PBL namely using Canva and Instagram, is successful in helping students improve their writing abilities [58]. Additionally, the students viewed PBL as a tremendous opportunity for them to enhance their writing and their creativity as growing after brainstorming, altering their writing using the Canva program, and publishing their work on Instagram. PBL, according to the students, was challenging, inspiring, and interesting, and it helped them to expand their creativity, critical thinking, and deal with actual problems in a relevant setting. To summarize, such PBL is beneficial for EFL teachers delivering writing courses at the university level [59]. Furthermore, their presentation was more successful in providing themes relevant to the LMS since they can also access open-source video/audio links and various software packages, namely Kahoot, Quizlet, and Grammarly on the LMS. According to the findings, the produced project-based program, which was uploaded on the LMS, was helpful in producing written project for the student-teachers. Furthermore, students' total accomplishments have been deemed adequate because no one failed the writing project. In addition, students are very interested in implementing the PBL using the HelloTalk application for English writing skills [68]. The PBL paradigm was successfully utilized to learn to write in English using the HelloTalk program. The results show that utilizing the HelloTalk program through the PBL approach can increase the student's writing skill.

Hereinafter, in terms of reading skill, teaching critical reading by video trailer application through PBL PBL in comprehending a couple of stories was seen as a stimulant for EFL learners to strengthen their critical reading skills [43]. The statistics showed that integrating technology into literacy practice was enjoyable for engaging pupils in learning the language while also boosting critical reading since the video project was feasible for all of the participants. In addition, the students actively engaged during the lecture and felt challenged in completing the assignment [43]. The findings of Yimwilai's study demonstrated that the use of PBL through multimedia and storyboard applications can improve EFL students' critical reading abilities [12]. This approach promoted students' active engagement, such as participation in activities, inquiry-based learning, cooperative learning, and teamwork, while applying PBL. Particularly, the finding indicated that technology-enhance PBL aided students' 21st-century competencies, namely collaboration, communication, and IT skills. A classroom environment is critical for adequate self-esteem to build in connection to learning. Most students preferred PBL by using technology because it allowed them to study outside of the classroom, in a more favorable and interesting atmosphere.

Based on the aforementioned explanation, it can be summarized that information and communication technologies (ICT) have significantly contributed to project optimization or PBL. Thus, technologies can enhance the effectiveness of PBL characteristics by increasing involvement and facilitating communication, as well as by promoting work, an interdisciplinary approach, and teaching based on real-world issues and circumstances. In addition, technology has the capacity to sustain student enthusiasm and promote student learning and doing throughout the project's many phases. Technology may enhance and supplement instructors' educational efforts, relieving them of some of the complexity associated with project implementation. The findings of the reviewed articles pointed out that there is a positive association between cooperation and communication abilities, implying that the more collaboration, the better communication skills. Therefore, technology-enhanced PBL improved students' 21st-century competencies.

5.3. The Challenges Experienced by Students in English Learning Through Technology-Enhanced PBL

By contemplating the aforementioned effect and benefits of technology-enhanced PBL, several researchers point out that the students in English learning also experienced challenges. As reported in the study conducted by Phu-ngamthong [47] once the students got significant experience and improved their English speaking skill, they got into several difficulties in finishing the project [47]. Most of the students have never finished a project before. As a result, they found it difficult to do so. They also had conflicts with a group member. Implementing PBL that is integrated with digital technology requires students to be resilient enough to transition to a new learning style. This finding is congruent with the study of Mafruudloh and Fitriati [45] who states that the setting in which PBL was introduced was critical in impeding the efficient implementation of technology-integrated PBL [45]. As a result, some students were unprepared for the digital technology-enhanced PBL implementation. They also lacked collaborative abilities. There are just a few students who are energetic and dominant in class. Furthermore, the research findings reveal that this technique challenges the students to exhibit their capacity to function as a team.

Furthermore, in the implementation of technology-enhanced PBL could be possible that one student in the group dominate ideas while disregarding feedback from other team members, or vice versa [48, 49, 66]. This circumstance may have an impact on students' learning experiences since they may feel inferior and ignored. At the end of the session, the students were evaluated by their peers and were asked to evaluate the performance of the group members. Then, the most common issues they encountered challenges as follows: (1) Difficulty in organizing time to complete tasks because of some personal matters to deal with, (2) Different points of view concerning the concept of the project, (3) Finishing a different assignment of another subject, which made them anxious and inclined to blaming others' mistakes, (4) Sometimes, the instrument used to capture or edit the video did not perform adequately, (5) During the distance learning sessions and virtual classrooms, some students reported technological issues. These problems emerged due to a weak connection to the internet, a lack of IT skills, and a loss of motivation for using ICT tools in teaching especially during COVID-19 pandemic.

In addition, students experienced several challenges in the utilization of technology-enhanced PBL [51]. In terms of issues, time constraints and challenges in overseeing students' work emerged as major issues. Because English was provided only once a week, encouraging pupils to practice language and completing their assignments was difficult. It was also difficult to monitor pupils' progress in creating their videos. This is because the online learning technologies employed in the teaching process have limitations. Next, the primary goal in English studies nowadays is to produce the language and apply it in conversation. As a result, students must be able to write and speak fluently in the intended language, in the case of English. Yet, many students remain unmotivated to enhance their communication ability in and outside the classroom.

In conclusion, the challenges encountered by the students and teachers, as described above, should be explored and become the next concern for future researchers. Nevertheless, this learning strategy was effective and useful in improving students' English ability at higher education in some countries. This approach is also appropriate and in line with 21st century learning skills that must be mastered for all, especially university students. Therefore, implementing technology-enhanced PBL is suggested to apply in English learning to improve students' English skills and soft skills for their future careers.

5.4. The Network and Connection Visualization of Technology-Enhanced PBL and English Ability

The researchers applied VOSviewer software to conduct Bibliometric analysis in accordance with the data source. The articles' RIS were inserted to VOSviewer, and selected type of analysis and counting methods through co-occurrence and keywords were employed by the researchers. Next, 66 keywords were found, and 46 items were connected. According to the result of Bibliometric analysis of the article's keywords, it was found that the network and connection among the keywords and clusters. According to the result of Bibliometric analysis of the article's keywords, it was found that the network and connection among the keywords and clusters. There are 6 clusters in Figure 5: red, blue, dark blue, green, purple, and yellow. The first cluster has 6 items, the second until the fourth cluster has 5 items, the fifth has 4 items, and the sixth cluster has 2 items of keywords. Despite the keywords being classified into different clusters, the following representation reveals that they are interrelated within several clusters. As an example, the keyword "project based learning" (shown by the blue node) is linked to the terms "speaking skill" (represented by the red node), "motivation" (represented by the green node), and "communication skills" (represented by the yellow node). It means that the four clusters have strong connections. The findings are shown in Figure 5.

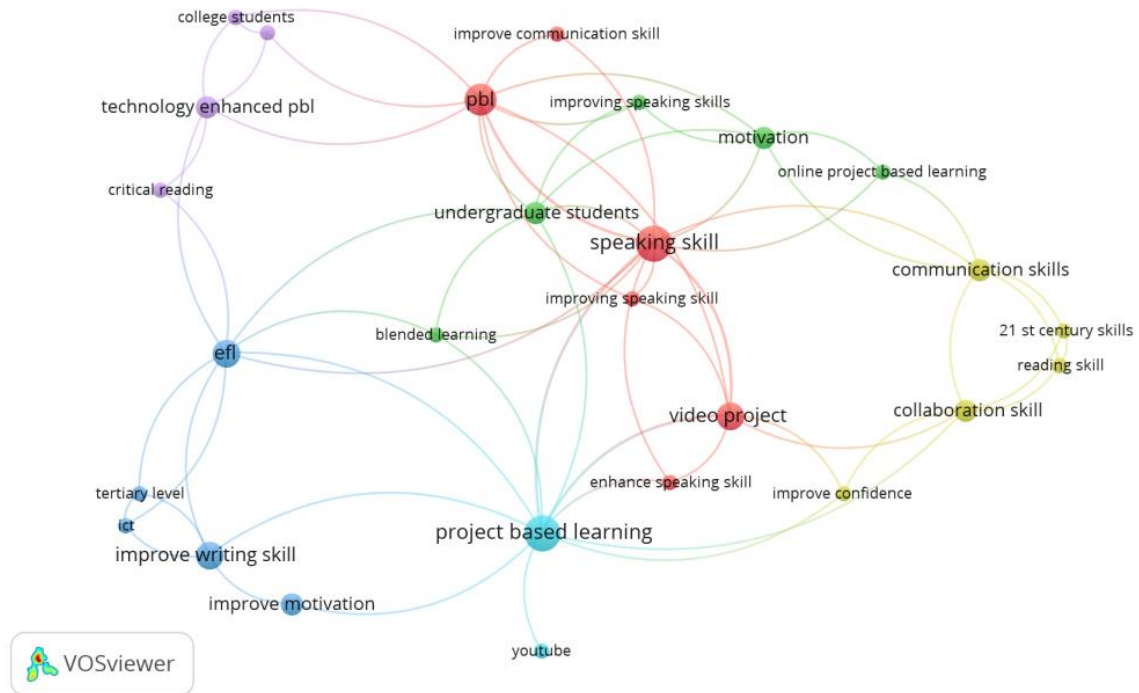


Figure 5.
Network visualization analysis.

Figure 5 presents that there are connections of the concept structure among the clusters. The various colored lines reflect the keywords' cluster of co-occurrence. The larger the keyword, the more influencing it is, and the more assertive the line linking the keywords, the more frequently they have co-occurred. Next, to examine the overlay visualization of the data can be shown in Figure 6.

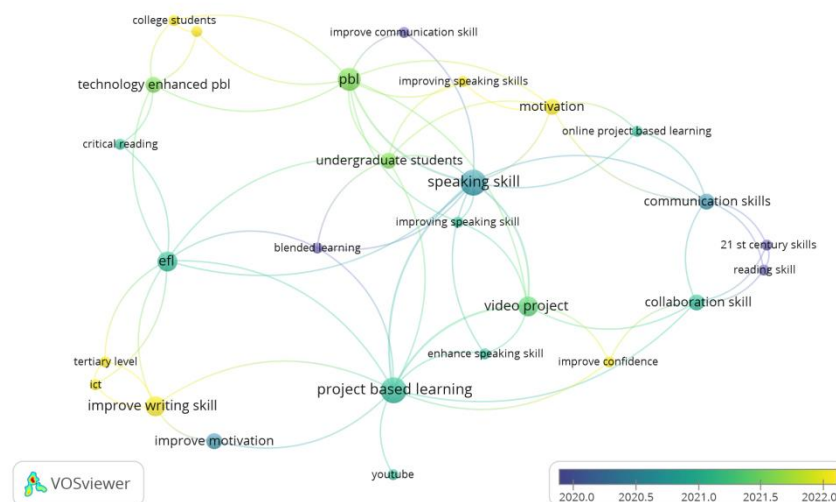


Figure 6.
Overlay visualization analysis.

Figure 6 describes that most of the studies conducted by the previous researcher in the articles are the keywords, namely project based learning, speaking skill, and video project since the nodes are bigger among the other nodes. The current studies (in 2022-2023) are about implementing technology-enhanced PBL to improve students' writing skill and motivation in college students or at the tertiary level. In addition, Figure 6 also presents that PBL through video has a relationship in improving students' English skills and soft skills, namely speaking, writing, motivation, communication, and collaboration skills. However, the studies discussing implementing PBL to improve students' confidence, reading, and listening skills at higher education levels are still limited since the nodes are smaller than the others. It means that there are a few studies conducted by the researcher related to those keywords. Therefore, this finding can be an opportunity for the following researchers to explore the next research on implementing technology-enhanced PBL or OPBL.

6. Conclusion

The present study used a systematic literature review. The findings of this study were: (1) Several platforms or programs were used to deploy digital technology-enhanced PBL in university students' English learning, (2) The implementation of technology-enhanced PBL had a significant effect on improving students' English ability and 21st-century learning skills, namely communication skills, collaboration, and creative and critical thinking, (3) Students experienced challenges in implementing technology-enhanced PBL, namely conflicts with group members, difficulty in organizing time, technological problems, and lack of internet connection, and (4) There is a connection between technology-enhanced PBL and students' English ability. The present study sheds light on using technology through PBL to improve students' English and 21st-century learning skills. Nevertheless, this study only involved speaking, writing, and reading skills in higher education. It is recommended that future researchers investigate the effect of technology-enhanced PBL on listening skills in secondary and senior high school students to fill the research gap in this study

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