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Review

A Systematic Review of the Impact of Social Media on Project-Based Learning

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Abstract: Social media is an important tool for people to interact and communicate. It is widely used in project-based learning (PjBL) and is of great significance in promoting sustainable education. However, although research on the relationship between social media and PjBL has been conducted for many years, no relevant research has been found to summarize their relationship. This study aims to explore the background, impact and challenges of using social media for PjBL learning. This study adopts a structured systematic review process, through detailed searches of WOS, Scopus, EBSCO and ERIC, and selects research samples according to inclusion and exclusion criteria. A total of 23 studies that meet the criteria were included in this review. The results analyzed the impact of social media on PjBL and its influencing factors, revealing that social media effectively supports PjBL by facilitating real-time collaboration, resource sharing, and reflective discussions, thereby enriching the PjBL experience. Students reported increased motivation, improved teamwork, and enhanced digital literacy. However, challenges such as distraction, uneven participation, and privacy concerns were noted, highlighting the need for careful planning and clear guidelines. The study concludes that when strategically integrated, social media can be a powerful enabler of student-centered learning in PjBL and provide important support for sustainable education.

Keywords: project-based learning; sustainability of education; social media; educational technology

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1. Introduction

According to STATISTA, by February 2025, the number of social media users worldwide had reached 5.24 billion. Among them, the most popular social media sites include Facebook, YouTube, WhatsApp, Instagram, TikTok and WeChat, all of which have hundreds of millions of active users. With such a large user base, social media not only has a huge impact on people's lives, but has also been introduced into the field of education. As a technology and tool to support education, the value of social media has become increasingly prominent [1] and has gradually become an important part of digital education. Social media is considered to provide a platform for promoting collaboration, resource sharing [2] and interactive learning [3] in education and supplements the shortcomings of traditional education models and learning methods that cannot be learned anytime, anywhere and at a distance [4]. Some studies have indicated that these characteristics of social media may align with broader educational goals, including those associated with sustainable education, such as fostering long-term learning capacity and social engagement [5].

Although this is not the focus of this study, social media can be used as an educational support resource to promote sustainable development [6], which is of great significance to educational development. UNESCO has emphasized that sustainable education involves a lifelong learning process and contributes to learners' cognitive, social, emotional, and behavioral development [7], supported by appropriate pedagogical methods, technologies, and equitable access [8]. Especially in the post-pandemic era, social media continues to play a significant role in facilitating both online and blended learning across different educational systems [9,10], including its application in project-based learning (PjBL), which has shown potential to enhance various educational outcomes.

Rooted in social constructivism, PjBL is a highly adaptable and effective learning method that is practiced in various disciplines and emphasizes that students co-construct knowledge under the guidance of teachers [11]. Therefore, PjBL provides an environment for students to take responsibility for their own learning and develop skills through projects [12]. Therefore, PjBL is recognized as a transformative teaching method that emphasizes student-centered, team-based learning and solving real-world problems [13]. It is linked to the educational goals of the 21st century (such as cultivating critical thinking, teamwork, creativity, problem-solving skills, etc.) [14]; learners can acquire knowledge and skills by participating in real-world projects and solving real complex problems, improving the long-term effectiveness and cognition of the education system. Because of PjBL's strong adaptability and theoretical foundation, PjBL has gradually developed other similar methods in various disciplines, such as gamified project-based learning [15], Technology-Integrated Project-Based Learning [16] and team-based project learning [17]. Because of the above characteristics, PjBL is believed to be able to break through the traditional classroom and cultivate learners' broader knowledge sharing and lifelong learning methods. Some studies have also pointed out that its potential may be consistent with some sustainable education goals [18].

When social media is incorporated into PjBL learning practices, it provides a unique experience for PjBL learning, providing multidimensional perspectives and a rich environment to support complex learning. In addition, social media provides learners with new learning methods and opportunities, allowing social interaction and learning to occur in virtual platforms [19]. As researchers have shown, social media and Web 2.0 technologies are powerful supplements to higher education experience, not only promoting knowledge co-creation in class communities but also enhancing the interactivity and accessibility of learning [20]. By combining social media platforms with PjBL, educators can build a more inclusive and sustainable learning environment, promote the cultivation of collaborative problem-solving skills, and promote the long-term development and equity of education.

Prior to this, some studies have reviewed some of the research on PjBL, but the research focuses and backgrounds are different. For example, they focus on the methods, learning outcomes, technical tools and theories of project-based gamified learning (GPBL) [15], methods and strategies for implementing interdisciplinary online PjBL [21], the impact of PjBL on learning outcomes [22], and the impact and methods of technology on PjBL in pre-service teacher education [16]. Moreover, Wahyudi et al. [16] claimed that the factors that affect PjBL learning practices include modern digital technologies, and social media is one of the most popular digital technologies. However, although the review of other aspects of PjBL and the research on social media and PjBL are relatively mature, no systematic review reporting on their relationship has been found. As Snyder [23] emphasizes, academic research must build upon existing knowledge, as this connection forms the cornerstone of scholarly activity. Thus, a systematic literature review of the relationship between social media and PjBL is necessary. This study aims to review and organize existing research

on the background, perspectives, impacts, and challenges of social media in PjBL using a systematic literature review approach and answer the following research questions:

1. In which PjBL contexts has social media been integrated or applied in educational practice?
2. What are the positive and negative effects of social media use on the implementation and practice of PjBL?
3. Which elements of PjBL learning are influenced by the social media?
4. What factors influence the integration of social media into PjBL practices?

The findings will provide theoretical insights and practical teaching recommendations for integrating social media into PjBL and identify research gaps to guide future studies. These contributions are of great significance for advancing PjBL theory and incorporating social media into PjBL practice and may also offer potential implications for enhancing long-term educational outcomes.

The studies included in this study covered online teaching, hybrid teaching, and some face-to-face teaching scenarios. Most of the studies took place in the late or post-epidemic era, so most courses involved hybrid or offline teaching, and social media was used as educational technology in such teaching.

Given the vast array of social media platforms, this study does not intend to cover all existing research on social media and PjBL. Instead, it focuses on studies retrieved using the keyword "Social Media", "Digital Platforms", "Social Networking", "Social Networking Sites", "Web 2.0" and "Social Networks" and on six platforms with the largest user bases: Facebook, YouTube, WhatsApp, Instagram, TikTok, and WeChat.

2. Materials and Methods

This study was conducted in accordance with the PRISMA systematic review guidelines and has been registered with the project management platform OSF.io (available at https://doi.org/10.17605/OSF.IO/X7EUY).

2.1. Research Data Selection Criteria

All studies included in this review must meet all of the following criteria:

1. The research focuses on the relationship between social media and PjBL learning and must be in any field of educational research.
2. The research results include the impact of social media use on the PjBL learning process and learning performance.
3. Research design is qualitative, quantitative or mixed research.
4. The social media keyword search only includes research on social media, Facebook, YouTube, WhatsApp, Instagram, TikTok and WeChat.
5. The article type only includes peer-reviewed publications.
6. This study only focuses on one type of document: article.
7. The search date is from the establishment of the database to 18 March 2025.
8. The language is English.

Studies that meet any of the following criteria will not be included in this review:

1. The research focus or one of the focuses is not social media and PjBL learning, but only uses social media and/or PjBL as auxiliary research tools and methods or only mentions them.
2. Research in non-English language.
3. Non-peer-reviewed research.
4. The article type is something other than article.
5. Duplicate papers in the retrieved literature.

6. Papers that are inaccessible.

It should be pointed out that in this review, conference papers, conference proceedings and book chapters were excluded, and only peer-reviewed journal articles were included and focused mainly based on the following considerations. First, peer-reviewed journal articles undergo rigorous academic review and quality control, which can ensure the reliability, rigor and academic value of the research, while conference papers and book chapters often do not undergo the same rigorous review process and may have methodological limitations. Second, some studies in conference papers and book chapters may not be fully verified or lack systematic data support. In addition, the standards of different conferences and publications are different, which makes their research quality vary greatly, which may affect the credibility and comparability of the review. Therefore, only including peer-reviewed journal articles can help ensure the stability and comparability of research data and the scientific nature of research conclusions, thereby improving the overall quality of the review.

2.2. Search Strategy

The researchers conducted the first search in the four databases of Web of Science (WOS), Scopus, EBSCO, and ERIC on 21 November 2024 and obtained 15 journal articles that met the requirements. Then, the researchers expanded the search keywords in the four databases on 18 March 2025 and conducted a secondary search, adding 8 journal articles to the original 15, and finally obtained 23 journal articles for review. Among the four databases, WOS, Scopus, and EBSCO are characterized by wide literature coverage, high publication quality, and high international recognition, while ERIC is a professional database for education-related research. The keyword terms used in this study include "Project-Based Learning" and its variants or commonly used abbreviations, such as project based learning, PjBL, PBL, and PrBL. In addition, due to the evolution of project-based learning in some studies, other related models derived from PjBL have emerged, such as Interdisciplinary Project Learning [24], team-based project learning [25], STEM Project Learning [26], and Team-Based STEM Project Learning [27]. These models and learning approaches retain some characteristics of project-based learning; therefore, this study also includes "Project Learning" as a search keyword. Regarding social media, the study focuses on the keywords "Facebook", "YouTube", "WhatsApp", "Instagram", "TikTok", "WeChat", "Social Media", "Digital Platforms", "Social Networking", "Social Networking Sites", "Web 2.0" and "Social Networks". These six platforms were selected because they are among the most popular social media brands globally and have the largest user bases [28], representing the main influence of social media on education, and their research results are more representative and universal [29]. The keywords "Social Media", "Digital Platforms", "Social Networking", "Social Networking Sites", "Web 2.0" and "Social Networks" are used to ensure that more social media platforms used in PjBL education are covered, thereby enhancing the diversity of the data included in this study and ensure their inclusion in the study, thereby minimizing potential bias in the data and results. The keyword search strategy employed in this study is outlined in Table 1. All articles considered are sourced from peer-reviewed journals within the four databases. Titles, abstracts, and keywords are screened according to the established research selection criteria, with non-article formats excluded. The subsequent step involves evaluating the full text of the relevant articles.

Table 1. Keyword search strategy.

Term	Search Keywords
Project-Based Learning	"project-based learning" OR "project based learning" OR "PjBL" OR "PBL" OR "PrBL" OR "project learning" OR "project-based"
	AND
Social Media	"social media" OR "digital platforms" OR "social networking" OR "social networking sites" OR "Web 2.0" OR "social networks" OR "Facebook" OR "YouTube" OR "WhatsApp" OR "Instagram" OR "TikTok" OR "WeChat"

2.3. Data Extraction and Synthesis

The initial search utilized library and online resources to search four databases—Scopus, WOS, ERIC, and EBSCO—based on title, abstract, and keywords, yielding a total of 1231 records. Specifically, 549 records were retrieved from Scopus, 313 from WOS, 241 from ERIC, and 83 from EBSCO. According to the PRISMA flow diagram (see Figure 1), the study first excluded 167 duplicate reports, as well as non-English articles, conference proceedings, books, book chapters, review articles, conference reviews, early-access papers, data papers, and corrections through the database automatic exclusion function, totaling 431 items, reducing the number of retained articles to 633. After carefully reviewing the titles, abstracts, and keywords of these articles, it was determined that 83 articles mentioned the social media and project-based learning (PjBL) keywords relevant to this study and met the criteria for full-text review and scoring. During this process, 3 articles that could not be downloaded were excluded, and 24 articles that were irrelevant and 4 articles that were classified as review articles were excluded. Subsequently, the abstracts and full texts were thoroughly reviewed and scored, resulting in the exclusion of another 29 articles for the following reasons:

1. Social media or PjBL was only used as a tool or method to support other studies, without focusing on the relationship between social media and PjBL.
2. The study relied on social media or proprietary media packages developed by researchers that are not publicly available, or the social media mentioned was only a very subtle component of these media packages, and it was impossible to distinguish whether the social media part had an impact on PjBL.
3. PjBL was used in combination with other learning methods, so its specific impact on PjBL could not be determined.

Finally, 23 articles remained that specifically studied the relationship between social media and PjBL. These 23 articles were included for further review and analysis.

All the aforementioned literature and data were stored in Zotero for subsequent review and data analysis. Furthermore, given that the 23 articles included in the final review employed diverse research methods and presented varying outcome predictions, this study is deemed unsuitable for meta-analysis and is more appropriate for narrative synthesis.

2.4. Quality Assessment of Research Papers

As suggested by PRISMA and Kitcheham and Charters [30], in addition to applying general inclusion and exclusion criteria when designing research articles, it is essential to assess the quality of the included studies. Accordingly, this review conducted a quality assessment of all 23 articles included in the final review. The articles were first categorized into three groups: quantitative research, qualitative research, and mixed-methods research. Subsequently, the 23 articles were evaluated using eight quality assessment criteria recommended by Kitcheham and Charters [30]. These criteria were framed as questions:

1. Is the research objective clear?

2. Does the research design align with the research objectives?
3. Does the study involve a control group (for quantitative research), or how clear and coherent are the study procedures and reporting (for qualitative research), or are the study procedures/control groups clearly described (for mixed-methods research)?
4. Are the study sample size, recruitment method, sampling method, and sample selection criteria reasonable?
5. Are the study data collection and analysis procedures clearly described?
6. Does the study provide interpretations of reliability and validity?
7. Do the study results contribute to the existing literature?
8. Does the study enhance knowledge and understanding?

Each question was scored on a three-point scale: 1 point for "yes", 0 points for "no", and 0.5 points for "partial". Consequently, the overall quality assessment score for each article ranged from 0 to 8 points. It is noteworthy that while quality assessment is critical for evaluating the methodological robustness of the included studies, it should not serve as a basis for excluding articles. As recommended by McKenzie et al. [31], studies that meet the predefined eligibility criteria related to the research question should be included, even if their quality scores are not high.

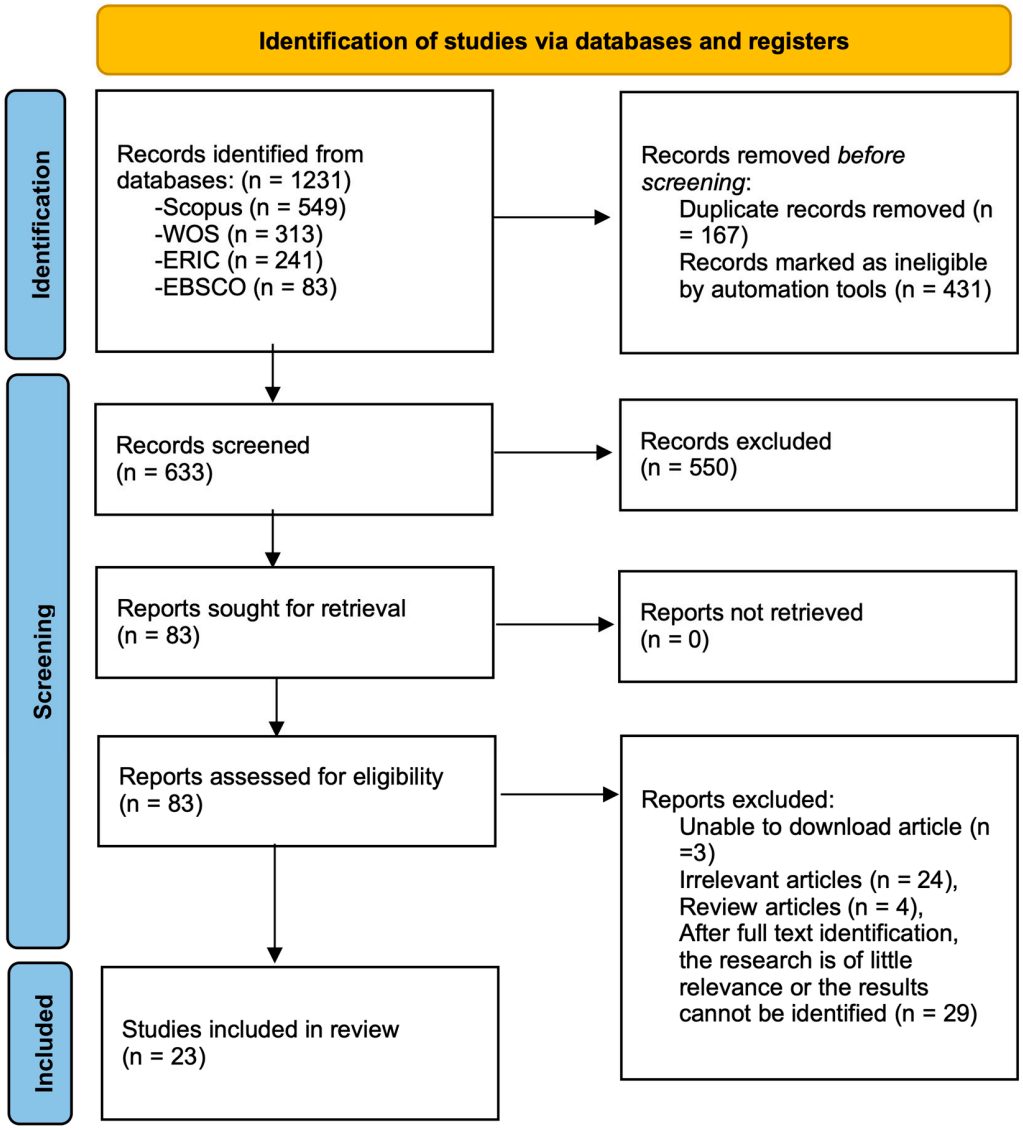

Figure 1. PRISMA flow chart: reasons for and number of inclusions and exclusions.

According to the requirements of PRISMA, quality assessment of included research can effectively assess the risk of bias in included studies and help support the credibility of the results of this study [32]. In addition, quality assessment of the literature helps to identify the limitations and research gaps of existing research in the conclusions, especially in empirical research [33]. Although this study only included peer-reviewed articles, which to a certain extent ensured the reliability, bias control and result interpretation of the study, this does not mean that these articles have no limitations in the research process, such as defects in research methods. Therefore, quality assessment of included articles can help reveal these limitations, provide improvement directions and references for future research, and provide a strong basis for practical application.

2.5. Coding

Following a comprehensive review of the 23 articles, the study classified and coded their content. The codes included the following elements: ID, author, publication year, publication journal, social media platform, practical subject area, research method, research sample, data collection tools, data analysis methods and tools, research objectives, research findings, and research limitations. Among these, the research findings primarily addressed the conclusions that responded to the research questions.

3. Results

The 23 papers included in this review and analysis were published between 2009 and 2024. All articles included came from all four databases, and no database excluded all articles. Table 2 shows the studies (codes) included in each database and their proportion. Among them, the database containing the largest number of articles is Scopus, with a total of 20 articles. The database with the smallest proportion is EBSCO, involving two articles. WOS and ERIC have five and nine articles included, respectively. The article with code 10 appeared in all four databases.

Table 2. The Studies Included in Each Database.

WOS	Scopus	ERIC	EBSCO
02, 05, 10, 17, 23	01, 03, 06–23	02, 07, 08, 10–13, 17, 18	04, 10

As illustrated in Figure 2, the field of English education exhibited the highest number of studies integrating social media into PjBL courses, accounting for a total of seven studies (7 studies). Business management education (4 studies), computer education (3 studies), art and design education (2 studies) and mechanical engineering education (2 studies) each featured two related studies. The remaining subjects included one study each: sociology (1 studies), music education (1 studies), mental health education (1 studies), mathematics education (1 studies), chemistry education (1 studies), translation and interpreting education (1 studies) and cosmetology and beauty education (1 studies). Notably, the study categorized under sociology did not specify particular subjects or courses, instead encompassing all sociology-related subjects or courses within the institution where the research was conducted. Furthermore, one study spanned multiple disciplines, including management education, English education, and engineering education. Consequently, the total number of studies represented in Figure 2 exceeds the total study count indicated by the study IDs.

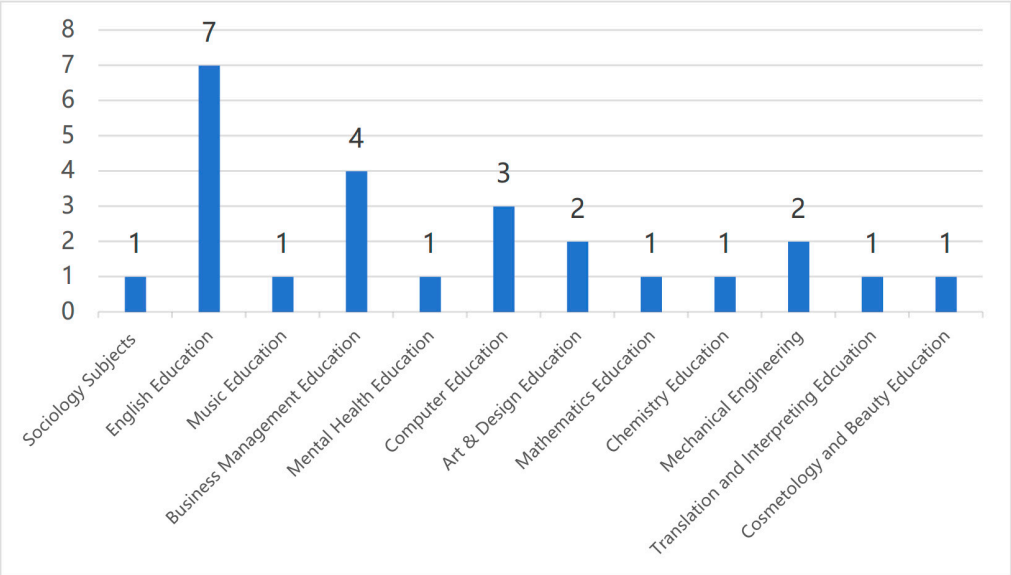

Figure 2. Social media use in PjBL subject fields.

The courses examined in the 23 articles included in this study vary significantly. The five studies on English education addressed diverse courses, including English Upper-Intermediate Prep, English Language Studies, English for Professional and Academic Communication, English for Academic Purposes (EAP), and English for Communicators ESP. Notably, one study included samples from three distinct professional field courses: English Language Studies (ENGL), Information Management (BSIM), and mechanical engineering (MECH). The two studies on computer education were conducted in courses titled Introduction to Computer Networks and Multimedia and Computer and Network Engineering (TKJ). Similarly, the two studies on art and design education focused on Appreciation of Arts and Design Aesthetic and Digital Media Design courses. The courses featured in the remaining studies, along with their corresponding paper IDs, are detailed in Table 3.

The 23 studies were categorized based on their research methods. As shown in Table 3, ten articles employed quantitative research methods, identified by the IDs 01, 04, 08, 10, 13, 14, 15, 17, 22 and 23. Five articles identified by the IDs 06, 12, 16, 18 and 19 utilized qualitative research methods. Eight articles adopted mixed research methods, with IDs 02, 03, 05, 07, 09, 11, 20 and 21. A quality assessment was conducted for these 23 studies, involving the design of eight evaluation criteria tailored to the respective research methods, which were used to assign scores (see Table 4). The scores ranged from 4 to 8 points (out of a total of 8), with an average score of 6.4. The evaluation criteria for the three research methods primarily focused on Q3, which assessed the clarity of the control group and study process; Q4, which evaluated the rationality of the sample size, sampling method, and sample description; and Q6, which evaluated the reliability and validity of explanations (see Section 2.4). Table 3 presents the findings of the quality assessment based on specific criteria. Most studies articulated clear research objectives and implemented appropriate research designs. Additionally, all articles documented their research processes. However, among the quantitative studies, only three articles reported employing a control group (Q3), despite variations in the description of sample sizes across the research methods. Specifically, the sample sizes in the nine quantitative studies ranged from 43 to 357 participants. The seven qualitative studies had sample sizes ranging from 6 to 75 participants, while the seven mixed-method studies involved sample sizes between 52 and 100 participants. Among them, ID 16 only has six research participants because it adopts the qualitative method of

focus group interview. According to the research recommendations of Kitchenham and Charters [30], a study with a sample size exceeding 40 is considered to be of excellent quality. Nevertheless, it is noteworthy that among all 23 studies, only one provided a relatively detailed description and explanation of the sample size, sampling method, and sample characteristics. Adekantari [34] described the sample size and reported the use of random sampling, offering a detailed account of specific sample indicators in the class where the target sample was located. However, the study did not mention the recruitment process, despite its importance in ensuring the overall quality of research findings and facilitating meaningful conclusions [35]. The remaining twenty-two studies lacked at least two elements among the sampling method, recruitment process, sampling process, or sample selection criteria. Additionally, all 23 articles described their methods of data collection, collection tools, and analysis techniques to varying extents (Q5). However, seven articles (IDs 06, 09, 11, 14, 16, 19 and 23) did not provide detailed accounts of these aspects. Regarding the reliability and validity of the research (Q6), sixteen articles addressed these considerations.

Table 3. Social media use in PjBL courses.

Study ID	Research Corresponding Courses
01	Courses of Sociology Subjects
02	English Upper-Intermediate Prep classes
03	Introduction to Music Education Technology course
04	Business Ethics and Sustainability courses
05	English Language Studies, Information Management and Mechanical Engineering course
06	English for Professional and Academic Communication" ESP course
07	Online course of The Introductory Course of Mental Health
08	Introduction to Computer Networks course
09	Realistic Mathematics Education course
10	Appreciation of Arts and Design Aesthetic
11	English for Academic Purposes (EAP) courses
12	Digital Media Design course
13	English for Communicators ESP class
14	Multimedia (MM) and Computer and Network Engineering (TKJ) course
15	Chemistry
16	Doing English Digital
17	Web Applications Design (WAD) in Computer Science course
18	English for Science and Technology (EST) course
19	Internet and Social Media Marketing course
20	Translation and Interpreting (MTI) program
21	e-Business Management (IMeBM) course
22	Cosmetology and Beauty education
23	Machine Learning Professional Elective course

3.1. The Positive Effects of Social Media on PjBL

Table 5 highlights the types of social media included in each study and the reported positive effects of social media on PjBL, focusing on the main findings. The initial coding excluded details such as journals, courses, research methods, designs, samples, and purposes. Among the 23 studies, eleven types of social media were utilized in PjBL teaching: YouTube (n = 6; IDs 03, 09, 11, 13, 18, 23), Instagram (n = 5; IDs 01, 06, 14, 15, 19), Facebook (n = 4; IDs 08, 10, 12, 19), Blog (n = 4; ID 16–18, 21), WhatsApp (n = 1; ID 02), WeChat (n = 2; ID 07, 20), Wiki (n = 2; ID 05, 20), Line (n = 1; ID 04), Twitter (n = 1, ID 17), TikTok (n = 1, ID 19), and LinkedIn (n = 1, ID 23). Among them, some studies have adopted a variety of social media interventions in PjBL learning, such as IDs 17–19, 21 and 23. However, ID 22

is an exception because the researchers did not mention any specific social media in the study and simply used the term "social media" to summarize it.

Table 4. Quality assessment result.

Research Methods	Study ID	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Total
Quantitative Research	01	1	1	1	1	1	1	1	1	8
	04	1	1	0	0.5	1	1	1	1	6.5
	08	1	1	0	0.5	1	0.5	1	1	6
	10	1	1	1	0.5	1	1	1	1	7.5
	13	1	1	0	0.5	1	1	1	0.5	6
	14	1	1	1	0.5	0.5	0.5	1	1	6.5
	15	1	1	1	0.5	1	0.5	0.5	0.5	6
	17	1	1	0	0.5	1	1	1	1	6.5
	22	1	1	0	0.5	1	1	1	1	6.5
	23	1	1	0.5	0.5	0.5	0	0.5	0.5	4.5
Qualitative Research	06	1	1	0.5	0.5	0.5	0	1	0.5	5
	12	1	1	1	0.5	1	0.5	1	0.5	6.5
	16	1	1	1	0.5	0.5	0.5	1	1	6.5
	18	1	1	1	0.5	1	0	1	1	6.5
	19	1	1	0	0.5	0.5	0	0.5	0.5	4
Mixed-Methods Research	02	1	1	1	0.5	1	1	1	0.5	7
	03	1	1	1	0.5	1	1	1	1	7.5
	05	1	1	1	0.5	1	1	1	1	7.5
	07	1	1	1	0.5	1	0	1	1	6.5
	09	1	1	1	0.5	0.5	1	1	1	7
	11	1	1	1	0.5	0.5	0	1	0.5	5.5
	20	1	1	1	0.5	1	0.5	1	1	7
	21	1	1	1	0.5	1	0	1	1	6.5

Table 5. Positive effects of social media on PjBL.

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Positive Effects of Social Media on PjBL
01	Adekantari [34]	2020	Instagram	a, c, e, f	Facilitates time utilization; supports multiple teaching functions; improves inquiry skills; promotes academic achievement and learning performance; improves critical thinking
02	Avci et al. [36]	2017	WhatsApp	a, b, c, e, g	Strengthen basic knowledge; promote effective communication; support time management convenience; promote team collaboration; facilitate project progress; remove communication barriers; support real practice and practice vocabulary knowledge
03	Cayari [37]	2015	YouTube	c, d	Support experiential cultural practices; increase sense of achievement; increase satisfaction
04	Chen et al. [38]	2023	Line	a, b, d	Support individual contributions; assist in connecting teams; promote sharing of knowledge, belief in effectiveness, willingness to complete team tasks; strengthen a sense of connection; coordinate team processes; support efficient work and team efficiency; promote team performance and team learning performance

Table 5. *Cont.*

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Positive Effects of Social Media on PjBL
05	Chu et al. [39]	2017	Wiki	b, c, h	Enhance learning experience; provide group project experience; promote mutual learning; support effective learning and team collaboration; promote active participation
06	Gómez-Ortiz et al. [40]	2023	Instagram	a, c, g	Support the acquisition of subject knowledge; growth of skills; support experiential professional development; promote vocabulary acquisition; promote written communication skills and oral communication skills; support the generation of ideas, the accumulation of vocabulary and the completion of assignments
08	Hou et al. [41]	2015	Facebook	b, d, g, h	Promote positive emotions, social interaction, learning atmosphere, participation and knowledge understanding and sharing
09	Kusmaryono et al. [42]	2024	YouTube	a, c	Support learning convenience; promote skill growth; improve learning quality; support flexible learning and resource acquisition; promote understanding of concepts; increase learning interest and enthusiasm; support knowledge discovery; enhance learning memory; stimulate interest; promote real-world connections; improve learning performance
10	Lin et al. [43]	2013	Facebook	b, c, g	Assist in exchanging study materials; assist in discussing homework; increase willingness for online discussions; promote meaningful discussions
11	Miller et al. [44]	2012	YouTube	a, b, h	Assist in reviewing assignments; promote reflection and useful skills; expand the learning community; facilitate providing feedback; enhance motivational factors
12	Oh et al. [45]	2020	Facebook	d, h	Enhance intrinsic motivation; promote more effort and feedback
13	Rodríguez-Peñarroja [46]	2022	YouTube	a, c, f, h	Promote active learning and task performance; new research methods; increase project interest; enhance critical thinking skills; promote learning motivation
14	Salehudin et al. [47]	2021	Instagram	a, c, f, h	Assist the learning process; improve learning outcomes; more motivated; participate actively; promote experimental procedures and risk-taking; explore one's potential, passions and interests; promote a focus on creative learning
15	Widarti et al. [48]	2023	Instagram	a, c, f, h	Improve creative thinking; promote learning motivation; support internship activities; support the learning process; improve problem-solving skills; improve learning outcomes; reduce boredom among students
16	Zhang, W. [49]	2010	Blog	a, d, h	Promotes digital literacy skill development; improves learner self-identity; facilitates social and emotional support; promotes performance motivation

Table 5. *Cont.*

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Positive Effects of Social Media on PjBL
17	Popescu & Badea [50]	2020	Blog, Twitter	a, c, g	Support content space and cognition; support discussion space; support learning presence and social presence
18	Hafner & Miller [51]	2011	YouTube, EduBlog	c, e, h	Improves time management; motivates students to practice and improve weaknesses; provides opportunities for feedback and support; technology-based learning environment that promotes learner autonomy
19	Demirci, Lee, & Binamak [52]	2023	Facebook, Instagram, TikTok	a, h	Student motivation is significantly higher; attendance and participation are high; Student engagement and achievement are improved; overall learning outcomes are satisfactory as expected
20	Tekwa & Li [53]	2024	WeChat	a, b, h	Significantly improve collaboration; support multi-tasking; teams are able to self-organize, identify and fill various roles, and use multiple strategies to solve challenges
21	Grippa & Secundo [54]	2009	Wiki, Blog	a, b, d, g	Share ideas and knowledge resources, solve problems, complete assignments, and develop abilities and skills; reduce psychological barriers and social distance to communicate with experts; facilitate interaction, answer questions and make suggestions; promote learning communities; support idea sharing; better collaboration
22	Saputra et al. [55]	2024	Not provided	b	Positive impact on collaboration, but not significant
23	Palsodkar et al. [56]	2023	YouTube, LinkedIn	a, f	Promote problem-solving, critical thinking, project management abilities and skills

Twenty-two studies reported positive effects of social media on PjBL learning, which can be categorized into eight aspects: (a) Academic achievement and learning ability: fifteen studies reported improvements, such as enhanced abilities or skills (IDs 01, 06, 09, 11, 13, 15, 16, 21, 23), academic achievement or learning performance (IDs 01, 09, 13–15, 17, 19, 21), knowledge acquisition (IDs 02, 06, 09, 21), and team performance (ID 04, 20). (b) Collaboration and team building: nine studies highlighted benefits such as team collaboration (IDs 02, 05, 20–22), team connection (ID 04), team process coordination (ID 04), expanded learning communities (ID 11, 21), and material exchange/knowledge sharing (IDs 08, 10, 21). (c) Learning experience: thirteen studies reported positive effects, including support for practical experiences (IDs 02, 03, 05, 06, 09, 17, 18), promotion of the learning atmosphere (ID 08), resource acquisition (ID 09), self-identity construction (ID 16), alleviation of psychological barriers to communication (ID 21) and stimulation of effort and interest (IDs 09, 11–15). (d) Psychological and emotional development: Six studies (IDs 03, 04, 08, 12, 16, 21) identified improvements. For example, Cayari [37] highlighted enhanced achievement and satisfaction, while Chen et al. [38] reported increased task completion willingness. Other studies noted the promotion of positive emotions (ID 08), self-identity construction (ID 16), alleviation of psychological barriers to communication (ID 21) and greater effort (ID 12). (e) Time management and efficiency: Three studies (IDs 01, 02, 18) reported benefits. Adekantari [34] found Instagram effective for maximizing time use, while Avci et al. [36] and Hafner & Miller [51] highlighted the role of WhatsApp, YouTube, and

EduBlog in facilitating time management, respectively. (f) Creativity and critical thinking: five studies (IDs 01, 13–15, 23) highlighted benefits, including improvements in critical thinking (IDs 01, 13, 23) and creativity (IDs 14, 15). (g) Communication and exchange: six studies (IDs 02, 06, 08, 10, 17, 21) noted improvements in eliminating communication barriers, promoting written/oral communication, and enhancing discussion and feedback. (h) Motivation and engagement: eleven studies (IDs 05, 08, 11–16, 18–20) reported increased motivation and participation in PjBL learning.

3.2. The Negative Effects of Social Media on PjBL

Table 6 summarizes eight studies on the possible negative effects of social media on PjBL when used in PjBL learning. These studies mainly discussed the negative effects that social media may have on PjBL learning in seven aspects: (a) learning efficiency and goals, (b) communication, (c) psychology and emotions, (d) motivation, (e) creativity, (f) ethical and privacy concerns, and (g) knowledge co-construction. Specifically, nine studies (IDs 04–07, 10, 12, 17, 21, 22) reported that when social media was used in PjBL, it hindered learning efficiency or affected learners' focus on learning goals and they turned to other things. For example, studies 04, 06, and 10 all reported that learners used social media for other purposes, such as leisure, during PjBL learning [40]. These behaviors distracted their attention and generated a large amount of information that deviated from the learning topic [43]. ID 17 found that social media blogs and Twitter lacked a sense of teaching presence. ID 21 found that teachers and students had low usage of social media platforms. In addition, ID 22 suggested that social media may not be effective for PjBL collaborative learning. Second, four studies indicated that learners or teachers were concerned that the use of social media in PjBL learning might negatively effect learners' privacy (IDs 02, 04), or create ethical dilemmas for teachers (ID 06), or might expose learners to cyberbullying (ID 03). Third, study IDs 05, 12, and 21 reported that the use of social media in PjBL might have a negative effect on learners' motivation. In addition, three studies showed that social media had a negative impact on students' psychology or emotions in PjBL learning. Cayari [37] (ID 03) claimed in his study that learners might experience anxiety due to the need to present PjBL projects on social media. ID 19 found that forced groupwork had a negative impact on students' emotions, while ID 21 mentioned that students felt controlled by the teaching supervisor. Guo et al. [57] (ID 07) reported that the lack of non-verbal cues in communication on social media may lead to misunderstandings and produce meaningless exchanges, which negatively affects learners' communication. Finally, the study with ID 16 indicated that blogs did not seem to contribute to the co-construction of knowledge during the course.

Table 6. Negative effects of social media on PjBL.

Study ID	Author	Year	Social Media	Influence ID	Key Findings on the Negative Effects of Social Media on PjBL
02	Avci et al. [36]	2017	WhatsApp	f	WhatsApp raises privacy concerns
03	Cayari [37]	2015	YouTube	c, f	Intimidation and bullying on social media; anxiety or worry caused by sharing projects on social media
04	Chen et al. [38]	2023	Line	a, f	Privacy concerns; social media is used for leisure purposes rather than work

Table 6. *Cont.*

Study ID	Author	Year	Social Media	Influence ID	Key Findings on the Negative Effects of Social Media on PjBL
05	Chu et al. [39]	2017	Wiki	a, d	Social media Wikis are boring; social media Wikis are time-consuming; Social media Wikis lead to increased workload; social media Wikis have a negative impact on intrinsic motivation; Wiki use is not closely related to learning goals
06	Gómez-Ortiz et al. [40]	2023	Instagram	a, f	Distracting attention; social media brings ethical dilemmas
07	Guo et al. [57]	2021	WeChat	a, b	Social media lacks language cues, leading to misunderstandings; increased workload; produces meaningless communication
10	Lin et al. [43]	2013	Facebook	a	Facebook does not promote higher-level cognitive processes; there is a lot of off-topic content in online discussions
12	Oh et al. [45]	2020	Facebook	a, d, e	Social media is too much information, leading to confusion; social media hinders student motivation; social media hinders creativity
16	Zhang [49]	2010	Blog	g	Blogs do not facilitate knowledge co-construction
17	Popescu & Badea [50]	2020	Blog, Twitter	a	Lack of teaching presence
19	Demirci, Lee, & Binamak [52]	2023	Facebook, Instagram, TikTok	c, d	Forced group cooperation has a negative impact on emotions
21	Grippa & Secundo [54]	2009	Wiki, Blog	a, c	Feeling controlled by supervisor; low usage; low usage by educators; reduced collaboration and immediacy
22	Saputra et al. [55]	2024	Not provided	a	Ineffective for PjBL; no significant impact on collaboration

3.3. The Effect of Social Media on Elements of PjBL

This study summarizes which key elements of PjBL learning in all 23 studies are effected by the use of social media through Table 7. These key elements of PjBL learning come from the seven PjBL models proposed by Thomas [58]; Krajcik & Blumenfeld [59]; Larmer & Mergendoller [60]; Larmer, Mergendoller & Boss [61]; Ravitz [62] Parker et al. [63,64]; and Grant [65], including project/goal/centrality, driving problem/challenge problem/task, investigation/exploration/investigation, autonomy/student choice and voice/student self-determination, authenticity/artifact/product/formal publication, learning technology/learning resources/guidance/scaffolding, collaboration/cooperation, feedback/reflection/criticism/revision, and long cycle/time [58–65]. Among the 23 studies, the PjBL elements affected by social media include autonomy, collaboration, resources, time, authenticity, inquiry, feedback, public release, goals, scaffolding, formal release, reflection, and critique. Among them, 12 studies reported that the autonomy/student self-determination element was affected by social media; 8 studies reported that the collaboration/cooperation element was affected by social media; 5 studies were related to the resource element; 4 studies were related to the authenticity and inquiry elements; 2 studies mentioned the time element; and 1 study reported that the feedback, public release, goals, scaffolding, formal release, reflection, and critique elements were affected by social media. However, none

of the 23 studies proposed the impact of social media on the driving question/challenge question/task elements of PjBL.

Table 7. The effects of social media on PjBL elements.

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Effects of Social Media on PjBL Elements
01	Adekantari [34]	2020	Instagram	Time Resource	Instagram . . . has become a way to maximize the use of time . . .; Instagram offers a variety of facilities that can be used as a teaching medium . . .
02	Avci et al. [36]	2017	WhatsApp	Collaboration	. . . language courses supported by mobile technology can encourage more effective and collaborative learning . . .
03	Cayari [37]	2015	YouTube	Public presentation	Sharing the project with classmates, friends and strangers
04	Chen et al. [38]	2023	Line	Collaboration; Autonomy	. . . social media . . . strengthens the sense of connection among members of the learning community; . . . social media . . . has a strong influence on . . . effectiveness beliefs, followed by . . . willingness to complete team tasks . . .
05	Chu et al. [39]	2017	Wiki	Collaboration; Learning resources; Autonomy	. . . use Wikis . . . to collaborate in a team . . .; . . . in Wikis . . . collect resources on the topic; . . . using Wikis . . . negatively affects . . . intrinsic motivation
06	Gómez-Ortiz et al. [40]	2023	Instagram	Authenticity; Time	. . . professional Instagram . . . had very attractive multimodal material based on research that could be used for profiling with authentic goal strategies . . . . . . students were too focused on . . . Instagram. Sometimes, the class had to stop . . . the time allotted for their completion must be accurately designed.
07	Guo et al. [57]	2021	WeChat	Collaboration; Autonomy; Exploration	. . .emoticons and stickers . . . mitigate potential emotional conflicts . . .; . . . students feel more motivated to learn . . .; the exploration phase is a very important phase in online PjBL.
08	Hou et al. [41]	2015	Facebook	Collaboration; Projects/Goals; Autonomy	FB can be used to address the social interaction aspects of successful online learning communities; students are more engaged in the topic of discussion when using FB. Incorporating FB into learning activities may be beneficial in promoting student participation in learning activities.
09	Kusmaryono et al. [42]	2014	YouTube	Scaffolding; Learning resources; Autonomy	Teachers conveyed the impact of the development of digital technology on education, including . . . creating interesting learning video media . . . teachers have the ability to improve the quality of learning (mathematics learning) . . . teachers are required to have interactive learning management skills . . .; . . . students. . . have easier access to online learning resources . . . students' interest and enthusiasm for learning increase, especially to discover more knowledge.

Table 7. *Cont.*

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Effects of Social Media on PjBL Elements
10	Lin et al. [43]	2013	Facebook	Collaboration; Autonomy	. . . students' collaborative tendencies; incorporating Facebook into PBL activities can increase students' willingness to participate in online discussions.
11	Miller et al. [44]	2012	YouTube	Formal publication; Reflection/ Feedback; Authenticity; Autonomy	. . . reach a wide audience on YouTube;. . . provide students . . . opportunities to review . . . and reflect . . .; . . . provide feedback through Facebook, etc.; these documentaries are shared publicly through YouTube . . ., "real" audiences watch . . . the work; many students . . . put a lot of effort into perfecting their work.
12	Oh et al. [45]	2020	Facebook	Autonomy; Collaboration; Exploration/ Resources	Students gain opportunities for self-determination and independent choice in using social media . . .; the use of social media reduces. . . communication barriers; social media . . . provides more opportunities to access content related to their interests.
13	Rodríguez-Peñarroja [46]	2022	YouTube	Autonomy	YouTube. . . impact on student active learning . . .
14	Salehudin et al. [47]	2021	Instagram	Autonomy; Authenticity; Criticality; Exploration/ Resources	Students . . . will be more motivated and engaged; . . . Instagram social media-assisted learning model . . . enables students to experience meaningful and authentic learning processes . . .. model provides opportunities to enhance creative problem-solving processes and critical thinking . . . and provides students with opportunities to explore, understand and respect themselves in a community; Instagram provides rich benefits for learning resources.
15	Widarti et al. [48]	2023	Instagram	Autonomy	. . ..PjBL model with Instagram learning media application in the classroom . . . students are enthusiastic and motivated to participate in learning and are actively involved.
17	Popescu & Badea [50]	2020	Blog, Twitter	Autonomy; Collaboration; Investigation	In the PBL scenario, students have a high degree of freedom and flexibility in using social media tools . . . They have to collaborate in . . . investigation activities . . .
18	Hafner & Miller [51]	2011	YouTube, EduBlog	Authenticity; Autonomy	Students . . .exercise independent learning . . .. Technological learning environments offer the possibility of writing for real audiences . . .

3.4. Factors Effecting Social Media and PjBL

Finally, Table 8 summarizes the eighteen studies except IDs 01, 15, 19, 22 and 23, involving indicators of nine factors affecting social media and PjBL learning. They are (a) media literacy, (b) team communication and collaboration, (c) time management, (d) motivation and emotion, (e) instructional design, (f) media and tool characteristics, (g) cognition and experience, (h) cultural and disciplinary differences, and (i) personal factors. (a) Media literacy mainly refers to factors related to social media technology, which includes fear of

technology (ID 03) and learners' digital literacy (IDs 05, 06). (b) Team-related communication and collaboration factors include lack of informal communication and collaboration experience and fairness (ID 02), peer encouragement (ID 03), team knowledge sharing (IDs 04, 08, 10), team effectiveness (ID 04), team connection (ID 04), interactive communication process (IDs 04, 08, 10), cooperation tendency (ID 10), off-topic discussion (IDs 08, 10), communication delay (ID 16), communication frequency and time (ID 20) and information sharing (ID 21). (c) Time management factors involve five studies, 06, 08, 10, 11 and 20. Learners all mentioned the impact of time management and constraints on learning process and performance in PjBL learning using social media. The concept of time in ID 20 refers to the specific time when students communicate. (d) Motivational and emotional factors include satisfaction (ID 03), moral dilemma (ID 06), motivation (IDs 12, 13), sense of ownership (ID 12), self-regulation (IDs 12, 17), resistance and pressure (ID 12), learning autonomy (ID 13), self-efficacy (ID 13), and equality of identity (ID 22). Nine indicators have an impact on social media and PjBL learning. In addition, performance evaluation (ID 02), teacher participation (ID 02), instructional design (IDs 05, 06, 20), project goal design (IDs 08, 20), learning content design (ID 09), project task characteristics (IDs 10, 13) and creative learning methods (ID 14) all belong to (e) instructional design factors. (f) Media and tool characteristics also have an important impact on social media and PjBL. It is mainly proposed by articles IDs 10, 11, 14, 17, 18, 20 and 21. In addition, (g) cognitive and experiential factors are considered to include learning experience/prior knowledge (IDs 05, 06, 13), social presence (ID 07), cognitive presence (ID 07), and familiar media experience (ID 18). Regarding (h) cultural and disciplinary differences, the studies mentioned that learning culture (h) is positively correlated with team performance, and disciplinary differences (ID 05) have an important impact on students' views and actions on social media. In addition, ID 16 mentioned that cultural factors are closely related to the design of blogging activities. Finally, two studies (IDs 10, 20) found that (i) personal factors, specifically age, gender differences and personal self-role, lead to differences in social media use.

Table 8. Factors that effect social media and PjBL.

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Factors Effect Social Media and PjBL
02	Avci et al. [36]	2017	WhatsApp	b, e	Inadequate experience with informal communication and collaboration, equity, performance evaluation, teacher participation
03	Cayari [37]	2015	YouTube	a, b, d	Technophobia, peer encouragement, and satisfaction
04	Chen et al. [38]	2023	Line	b, h	Team knowledge sharing, team effectiveness, team connection, interactive communication process, learning culture
05	Chu et al. [39]	2017	Wiki	a, e, g, h	Subject differences, learning experience, technical background, instructional design
06	Gómez-Ortiz et al. [40]	2023	Instagram	a, c, d, e, g	Learning experience/prior knowledge, digital literacy, instructional design, time management, ethical dilemmas
07	Guo et al. [57]	2021	WeChat	g	Social existence, cognitive existence
08	Hou et al. [41]	2015	Facebook	b, c, e	Off-topic discussions, social interactions, project goals, knowledge sharing, time constraints

Table 8. *Cont.*

Study ID	Author	Year	Social Media	Influence ID	Key Findings of the Factors Effect Social Media and PjBL
09	Kusmaryono et al. [42]	2024	YouTube	a, e	Creative (teaching) methods, mastery of media technology, learning content
10	Lin et al. [43]	2013	Facebook	b, c, e, f, i	Knowledge sharing, project task characteristics, collaboration tendency, time management, off-topic discussions, social tool characteristics, age and gender, social interaction
11	Miller et al. [44]	2012	YouTube	c, f	Time management, technical support
12	Oh et al.	2020	Facebook	d	Motivation, ownership, self-regulation, resistance, and stress
13	Rodríguez-Peñarroja [46]	2022	YouTube	d, e, g	Learning experience, intrinsic motivation, project (characteristics)
14	Salehudin et al. [47]	2021	Instagram	d, e, f	Creative learning methods, technological tools, learning autonomy, self-efficacy
16	Zhang [49]	2010	Blog	b, h	Cultural factors, limited interaction, instructional design, delays in feedback and communication, limited reach, lack of peer feedback
17	Popescu & Badea [50]	2020	Blog, Twitter	d, f	Significant self-regulation and effort regulation, goal setting and project assignments; social media . . . learning presence
18	Hafner & Miller [51]	2011	YouTube, EduBlog	g, f	Familiar online environment; authenticity; meaningful textual media and context
20	Tekwa & Li [53]	2024	WeChat	b, c, e, f, i	Frequency of communication, task-related and non-task-related topics discussed, time of conversations, roles played by members, and preferred media types
21	Grippa & Secundo [54]	2009	Wiki, Blog	b, d, f	Knowledge base, equal roles, shared information, tools to support collaboration

4. Discussion

This review comprehensively analyzes the impacts of different social media platforms on PjBL and the factors contributing to these outcomes. The limited availability of empirical research literature on this topic suggests that the investigation of social media's impacts on PjBL learning remains in its exploratory stage. Given that social media is one of the most significant mediums for communication and learning, we speculate that research in this area will continue to advance and deepen. In total, 23 studies meeting this study's selection criteria were included in the review for further analysis. A comprehensive review of these 23 studies was conducted, focusing on six aspects: the disciplines and courses of practice, the quality of research, the positive and negative effects of social media use on PjBL learning, PjBL elements influenced by social media, and the influencing factors of social media use in the PjBL learning process.

Among the included studies, English education emerged as the discipline in which social media was most frequently used for PjBL learning. Following this, business and management education, computer education, mechanical engineering education and art and design education-related disciplines demonstrated increasing interest in the use of

social media for PjBL. Other disciplines included social sciences education, music education, mental health education, mathematics education, chemistry education, translation and interpreting education, and cosmetology and beauty education. These studies, spanning various major subject areas, illustrate the broad applicability of combining social media with PjBL as a learning method [66]. Moreover, all the disciplines or courses involved are inherently practical in nature (see Table 3). As Lalujan & Pranjol [67] argued, PjBL learning necessitates a real-world project context, maximizing learning outcomes when the educational environment closely mirrors the real-life situations in which students will apply their knowledge. However, Chu et al. [39] note that different subjects and courses may exhibit varying attitudes toward using social media in PjBL learning, necessitating subject-specific teaching designs supported by social media. Additionally, YouTube, Instagram, and Facebook were the most commonly used social media platforms in the 23 included studies, likely because they are the most widely used platforms globally [68]. The articles related to blog research are mainly concentrated in 2009–2011. This may be because in the current era, the social media platforms that dominate the user market are YouTube, Instagram and Facebook, and learners mainly define main role of blogs as content space rather than discussion space [50], which may be due to the delay in feedback and communication in blogs [49]. All included articles cover 11 kinds of social media, which fully demonstrates that different social media platforms have been integrated into PjBL learning and highlights its necessity and importance as an educational support tool. Therefore, as a ready-made learning resource, social media has a wide range of application potential and can be effectively used for educational support [3].

The critical question of this review is as follows: What impact does social media use have on PjBL learning, and how does it affect PjBL? Most studies discussed both the positive and negative effects of social media on PjBL learning, although some focused exclusively on one aspect.

Specifically, the most significant positive impact of social media on PjBL learning is to promote learners' academic performance, various abilities and skills. This is due to the rich, real-world-relevant materials provided by social media [42] and its engaging functionalities [44], which stimulate student interest [42]. These factors have been shown to improve learning performance effectively [48]. However, social media may also reduce learning efficiency due to addiction and over-reliance or impede performance by interfering with focus [69].

The positive impact of social media on PjBL, second only to academic performance and learning ability, is the enhancement of learners' experience and engagement. This may be attributed to social media providing learners with real-world experiences [37,45,46], access to resources [30,42], and the creation of a conducive learning atmosphere [41,44]. However, if students use social media excessively, it will hinder their participation in learning activities, mainly manifested in distraction and reduced learning time [69].

The positive impact of social media on motivation was mentioned in 11 studies. Motivation is another significant aspect influenced by social media. Many studies assert a positive relationship [46–48]. However, Chu et al. [39] and Oh et al. [45] both found that social media may have a negative effect on learners' intrinsic motivation. The reason may be that the use of social media brings an extra heavy workload, which makes students bored [39]. Another reason may be that teachers force students to use social media and regard it as a homework task, which causes pressure and resistance, thereby negatively affecting learning motivation [45].

In addition, the positive impact of social media on team collaboration and building in PjBL learning is largely attributed to the fact that it provides learners with opportunities to communicate with each other in teams and informal settings anytime and anywhere [36].

Social media also provides platform support for knowledge sharing [41] and exchange of learning materials [43] among learners, which is also considered to be conducive to learners' collaboration and may be beneficial to the establishment of subsequent learning communities [44]. However, Henderson, Snyder, & Beale [70] found that if not properly integrated, social media may hinder effective collaboration because it cannot meet educational requirements. Saputra et al. [55] argue in their study that the mediating role of social media in PjBL learning collaboration was very limited. To fully realize its positive impact in this context, careful consideration and appropriate guidance may be necessary [71].

While most studies highlight the positive impact of social media on team communication, few delve into the underlying reasons. Some researchers argue that the absence of non-verbal cues in social media may lead to misunderstandings [57]. Additionally, Chen et al. [38] found that learners often use social media for leisure rather than learning, as the primary function of social media is social interaction. However, Hou et al. [41] and Lin et al. [43] believe that frequent social interactions during online discussions and off-topic discussions in social media do not necessarily harm academic performance [36,40], because the easy-to-use interface and relaxed atmosphere of social media may make students more willing to participate in online discussions [44], and these insignificant communications and social interactions may lead to meaningful thinking [43].

Furthermore, the psychological impacts of social media on PjBL learners include both positive and negative aspects. The positive aspect is that PjBL learning supported by social media can promote learners' positive emotions [41], give learners a sense of accomplishment and satisfaction [37], and enhance their learning beliefs [38]. This satisfaction and accomplishment is mainly due to the results of the PjBL project [37], while the firmness of learning beliefs and positive emotions may be caused by the positive user experience of social media [38] and social interaction [41]. However, some learners may feel anxious because of the cold feedback from classmates for sharing PjBL products or the tension of comparison with peers' work [37]. Conversely, learners feel controlled by their supervisors because they are forced by teachers to use social media for PjBL learning [54].

Debates also exist regarding the effect of social media on creativity and critical thinking. While many studies advocate for its positive influence [34,46–48], mandatory use of social media may increase stress and hinder creativity [51].

Adekantari [34] and Avci et al. [36] highlight that social media can maximize time use and management, enabling communication without the need for face-to-face interaction. However, Chu et al. [39] reported that some students felt that using social media for learning consumed personal time and added excessive workload. Learners cited frustrations, motivation issues, and misaligned learning goals as factors contributing to the perception that social media wastes time. Furthermore, insufficient time for online discussions could lead to superficial engagement, limiting higher-order thinking [41].

Regarding PjBL learning elements, this study found that most elements from the seven PjBL models are influenced by social media. However, no study explicitly discusses its effect on the driving question/task element, warranting further exploration. Zhao [72] believed that the driving question created by students in the project was undoubtedly difficult for students because students' prior knowledge, interests and background may not be enough to support them to propose sufficiently professional driving questions [73]. However, Tang et al. [74] believe that PjBL should give students enough freedom to explore, including the design of driving questions. Teachers should assist students in proposing driving questions instead of leading and scripting [75]. These driving questions may be improved or expanded based on the information collected by students and the development direction of the project [75]. Social media can provide support in this regard. Therefore, the impact of social media on driving questions in PjBL can be one of the future research

directions, and other PjBL elements that have been proposed to be affected by social media also need to be discussed in more depth.

Finally, there are some suggestions for practice in this area. The following seven points should be noted about using social media for PjBL learning practice:

1. Promoting collaboration and fairness: Social media should be designed as a tool to promote team collaboration while paying attention to fairness to ensure that all members can actively participate. Teachers should be moderate when participating in group interactions to avoid students losing sincerity or pretending to work hard because of the presence of teachers.
2. Privacy and information security: When using social media, teachers should clearly define privacy protection measures to ensure that students' personal information and shared content will not be abused, thereby creating a safe and trustworthy learning environment.
3. Motivation and anxiety management: Setting clear learning goals and providing positive feedback can help students relieve anxiety caused by publicly sharing results or comparing with others, and enhance self-confidence and intrinsic motivation. It is important to avoid treating social media tasks as simply course requirements to enhance students' willingness to participate.
4. Technical support and digital literacy: It is suggested to provide students with sufficient technical training to improve their digital literacy and tool mastery to avoid the impact of technical burden on learning motivation and collaboration efficiency.
5. Optimize teaching design and time management: Teaching design should be closely related to subject objectives and career needs to ensure that students can understand the significance of their learning. Teachers should provide sufficient time for discussion and reflection to support deep learning and high-level knowledge construction, while avoiding inefficient participation due to time constraints.
6. Improve the quality of interaction and communication: The lack of non-verbal communication in social media can be supplemented, such as through clear language expression and consensus mechanisms, to avoid misunderstandings or inefficient discussions caused by poor communication. We should also focus on team knowledge sharing to promote efficient interaction and deep participation.
7. Regulate information burden: It is recommended that students should moderate their information exchange on social media to avoid information overload causing pressure on students.

5. Conclusions

In summary, the involvement of social media in PjBL learning provides valuable support for improving educational practices. This study reviewed the impact of social media on PjBL learning and its influencing factors. Specifically, the involvement of social media in different PjBL subject courses may produce different learning effects and have different positive impacts on the PjBL learning process. This study highlights the positive role of social media in enhancing the PjBL learning experience, as well as engagement, achievement, skill development, collaboration, creativity, motivation, psychological well-being, and learning efficiency. These findings support the significance of deeply integrating social media into PjBL to enhance educational effectiveness. At the same time, it identified the potential negative effects of excessive social media use, including distraction, reduced learning efficiency, emotional challenges, and diminished motivation. The study also revealed variations in attitudes toward and the effectiveness of social media applications across different disciplines, with platforms like YouTube, Instagram, and Facebook being widely utilized in educational practices globally. Moreover, this study offers valuable rec-

ommendations for teachers and learners regarding the use of social media in PjBL learning practices. These suggestions have the potential to positively impact teachers' management of PjBL instructional design, learners' overall learning performance, and the sustainability of education. In general, social media can provide PjBL learners with open and shared learning resources, foster creativity, develop various skills and abilities, contribute to learners' psychological and emotional development, enable education systems and educators to adapt to rapidly changing social needs, ensure the continuity and equity of learning, enable students to collaborate with team members of different cultures and backgrounds in real-world projects, improve comprehensive literacy and social responsibility, meet the goals of sustainable education, and promote the sustainable development of education.

This study still has several limitations. Regarding the evidence included in this review, only English-language research from four databases was considered, excluding relevant studies in other languages and databases. Additionally, this study focused only on publicly available peer-reviewed journal articles, omitting gray literature and unpublished works. Because the peer review process rigorously examines the rigor of research methods, data quality, and conclusions; it reduces research bias and improves the credibility of research results [76]. This study limited the scope of research to peer-reviewed journal articles, which helps to improve the quality of review results and ensure their reliability and validity in academic and practical applications. However, this limited scope and the exclusion of results from other databases and non-English studies may also introduce publication bias and affect the conclusions of this review. Secondly, while the number of studies on social media and PjBL in the WOS and SCOPUS databases has declined since the COVID-19 pandemic, the total volume of data remains substantial. Unfortunately, research focusing specifically on the relationship between social media and PjBL learning is still limited, which may have an impact on the findings of this study. Thirdly, the keyword search of this review involved a total of six social media platforms with the largest number of users, and it is expected for us to include more social media types through the keyword "social media". The final analysis of the research involved 11 social media platforms; however, the scope of existing platforms is very vast, so it may not be possible to include all of them. The characteristics and functionalities of these platforms vary significantly [77], and regional differences in social media preferences and usage patterns [78] may result in varying impacts on PjBL. These may limit the diversity and generalizability of the findings of this study. These aspects warrant further exploration in future research. Additionally, this review did not include a comprehensive pre- and post-search of the 23 selected studies, which may have led to the omission of valuable information. Future studies should include such searches to ensure a more exhaustive analysis. Furthermore, existing research rarely addresses the relationship, impact, and potential of social media for PjBL learning in underserved regions. Future investigations should focus on this dimension to promote equitable educational opportunities [79]. In addition, as mentioned above, most of the studies in this study have limitations in the research method design. For example, most of the quantitative studies in this study lack a control group, especially the rationality of the research sample. The defects of the research method may affect the research results [80]. Despite these limitations, this review provides a relatively fair insight into the impact of social media on PjBL learning. The limitations of the research method also provide important improvement directions for future research to further optimize the research design, improve data reliability, and expand the theoretical and practical applications of related fields.

Future research should address several key areas to enhance the understanding and application of social media in PjBL learning. Given the existing limitations in sample scope, methodological design, and regional applicability, future studies should focus on

refining social media-supported PjBL instructional design, exploring its adaptability across disciplines, and optimizing social media tools to achieve more equitable and efficient educational outcomes. Additionally, while teamwork is a fundamental aspect of PjBL and a prevalent mode of work in both present and future contexts, research on the relationship between social media and PjBL learning from a team perspective remains insufficient. Further investigations should examine how social media can enhance teamwork dynamics in PjBL settings, because teamwork in education is an important indicator for promoting the long-term sustainability of education [81]. Moreover, despite the recognized impact of instructional design on the effectiveness of social media in PjBL, there is a lack of in-depth exploration in this area. Therefore, future research should prioritize examining teachers' use of social media in PjBL instructional strategies to provide more structured and evidence-based guidance, thereby enhancing this research field's contribution to the advancement of sustainable education. Another important direction is to develop and evaluate social media tools and features designed specifically for PjBL learning to promote the sustainable development of education. These tools may include privacy-enhancing technologies and content recommendation algorithms to reduce information overload while optimizing students' collaboration and creative performance in different disciplinary contexts, thereby improving educational equity and efficiency and ensuring the long-term availability and adaptability of learning resources. Furthermore, while this study provides a comprehensive review of English-language research from four databases, potential biases in study selection and data coverage may affect the generalizability of the findings. To mitigate this, future research should seek greater diversity in sample selection and expand data sources to improve the applicability of results. Additionally, integrating meta-analyses and employing funnel analysis could help assess and minimize publication bias in meta-analytical studies.

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Abbreviations

The following abbreviations are used in this manuscript:

PjBL	project-based learning
WOS	Web of Science

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