

Review

Efficacy of Social Networking Sites for Sustainable Education in the Era of COVID-19: A Systematic Review

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Abstract: The sudden advent of the COVID-19 pandemic and the associated containment measures require educational institutions of all sizes to adopt eLearning as the only option for sustainable education. Despite the numerous Learning Management Systems, the rapid migration to eLearning posed numerous challenges that negatively affect the effectiveness and sustainability of the educational activities. The current study systematically reviewed recent articles that recognized the value and feasibility of using Social Networking Sites (SNSs) in education. The study highlighted the current eLearning challenges and illustrated effective strategies for the sustainable educational use of SNSs by both institutions, teachers, and students. Thus, solutions to the problems experienced in education during the COVID-19 period were highlighted based on SNS-supported strategies.

Keywords: social networking sites; social media; eLearning; COVID-19; education



Citation: Cavus, N.; Sani, A.S.; Haruna, Y.; Lawan, A.A. Efficacy of Social Networking Sites for Sustainable Education in the Era of COVID-19: A Systematic Review. *Sustainability* **2021**, *13*, 808. <https://doi.org/10.3390/su13020808>

Received: 7 December 2020

Accepted: 12 January 2021

Published: 15 January 2021

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1. Introduction

The use of Social Networking Sites (SNSs) in formal education remains under-investigated. Learning Management Systems (LMSs) are the common eLearning tools studied and used in formal education. However, despite the absence of definitive explanations on the educational value of SNSs, studies have demonstrated the preferential advantage of SNSs over current LMSs based on their convenience in sharing educational resources [1–3], collaborative learning capabilities [4,5], increased student/teacher engagement [6,7], and ease of use [8], among others. Furthermore, despite the essential features of LMSs that SNSs fall short of in supporting formal educational activities, the rapid evolution of the popular SNSs brings noble features that could replace the basic LMS functionalities. Although SNSs are not purposely designed to support educational activities, the need for incorporating social learning activities into LMSs, coupled with the availability and ubiquitous usage of SNSs within educational institutions, made them vital tools to consider in eLearning research and implementation [9,10].

The pause in traditional learning approaches due to the COVID-19 pandemic requires educational institutions of all sizes to adopt eLearning as the only option for sustainable educational activities [11–25]. However, the sudden advent of COVID-19 and associated containment measures adopted by governments across the world posed other peculiar challenges regarding the use of LMSs for eLearning [15,19–21,25,26]. Apart from the common challenges associated with LMSs, some of these peculiar challenges are associated with the need to assess users' readiness, the need for an informed decision on the most preferred and appropriate LMS to be used, and the need for student/teacher training on the essential features of the preferred LMS. The sudden closure of educational institutions impedes assessments of students'/teachers' LMS readiness, preferences, and training, among other challenges. Fortunately, these peculiar challenges could be addressed by

leveraging SNSs for eLearning. The limitation in the existing literature is the inability to provide a definitive explanation on leveraging SNSs in mitigating the peculiar educational challenges posed by the COVID-19 pandemic.

The research aim of this study is to explore best practices and the features in SNSs that could be used to successfully deploy or improve eLearning practices in the era of COVID-19. The study systematically reviewed the existing literature on eLearning using SNSs and illustrated how the current challenges could be addressed by transporting evidenced practices of eLearning with SNSs to the era of COVID-19. Previous literature reviews highlighted some of the best practices and strategies for a sustainable educational use of SNSs. However, none of the existing literature reviews systematically analyzed the subject area or related its findings to the sustainable use of SNSs in the era of COVID-19 [27–31]. For instance, Tess, Chiroma, and Vollum [29–31] reviewed related literature, described the feasibility of SNSs in education, and highlighted the negative effects of disruptive SNS use on students' performance. Similarly, Tsovaltzi [27] and Kirschner [32] reviewed the findings of three and four studies, respectively, on SNS's support for argumentative learning. Recently, Greenhow [33] proposed SNS-based educational guidelines for US higher institutions based on a brief literature review and the authors' own experiences on integrating SNS into traditional online teaching.

2. Methodology

2.1. Search Strategy

For this systematic review, the authors ensured the careful planning and allocation of tasks at each stage of the study. The systematic search, conducted in July 2020, was conducted across the four most popular scientific databases of the research area: Web of Science, Scopus, EBSCO, and PsycINFO, and the search terms used are ("e-learning" OR "education" OR "distance learning" OR "learning") AND ("social media" OR "social networking site" OR "Facebook" OR "WhatsApp" OR "Twitter" OR "YouTube"). All searches spanned a decade (i.e., from 2011 to the present) and included journal articles published with English titles. Beyond database search, we accessed relevant publications from the databases on the impact of COVID-19 on educational practices and reviews on the efficacy of SNSs for eLearning.

2.2. Selection Criteria

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [34] was followed in the selection process. Similar educational researches utilized PRISMA in the critical appraisal and summary of the literature to inform educational policy and practice [35–37]. The point of interest in the inclusion criteria included any published full-text research article on the use of the popular SNSs for educational practice. At the initial screening stage, apart from duplicates removal, three authors assessed the titles and abstracts against the criteria of inclusion. The authors decide on whether or not to include any of the articles in the systematic literature review by applying the inclusion/exclusion criteria from the screening plan to the titles and corresponding abstracts. The decision for inclusion/exclusion of any of the articles was coded under a designated column in the excel sheet imported from the databases. For titles and abstracts that satisfied the inclusion criteria, we retrieved the full-text copies of the studies for the next screening stage. At the subsequent screening stage, all the authors read the full-text articles independently to ascertain their relevance with regard to the search terms and the research aim. Any disagreements were resolved via a WhatsApp group discussion.

Specifically, 677 articles were assessed for full-text eligibility. Six hundred and twelve out of the 677 articles were excluded for the following reasons: full text not written in English ($n = 36$), part of conference proceedings ($n = 107$), literature reviews ($n = 14$), editorial materials ($n = 15$). Nonetheless, some full-text articles were relevant based on the search terms used but were eliminated because they concentrated on evaluating the performance of machine learning algorithms in predicting user interactions with SNS

($n = 92$), while others concentrated on evaluating behavioral models, and not on the actual use of SNSs for eLearning ($n = 348$). Additional articles were excluded based on the fact that the studies described instances of SNSs usage in organizational advocacy and other non-academic information sharing ($n = 34$). Table 1 itemizes the key items of the inclusion and exclusion criteria of the study. Consequently, 31 studies satisfied the inclusion criteria. The foregoing systematic literature review process was summarized with the help of a PRISMA flow diagram (Figure 1).

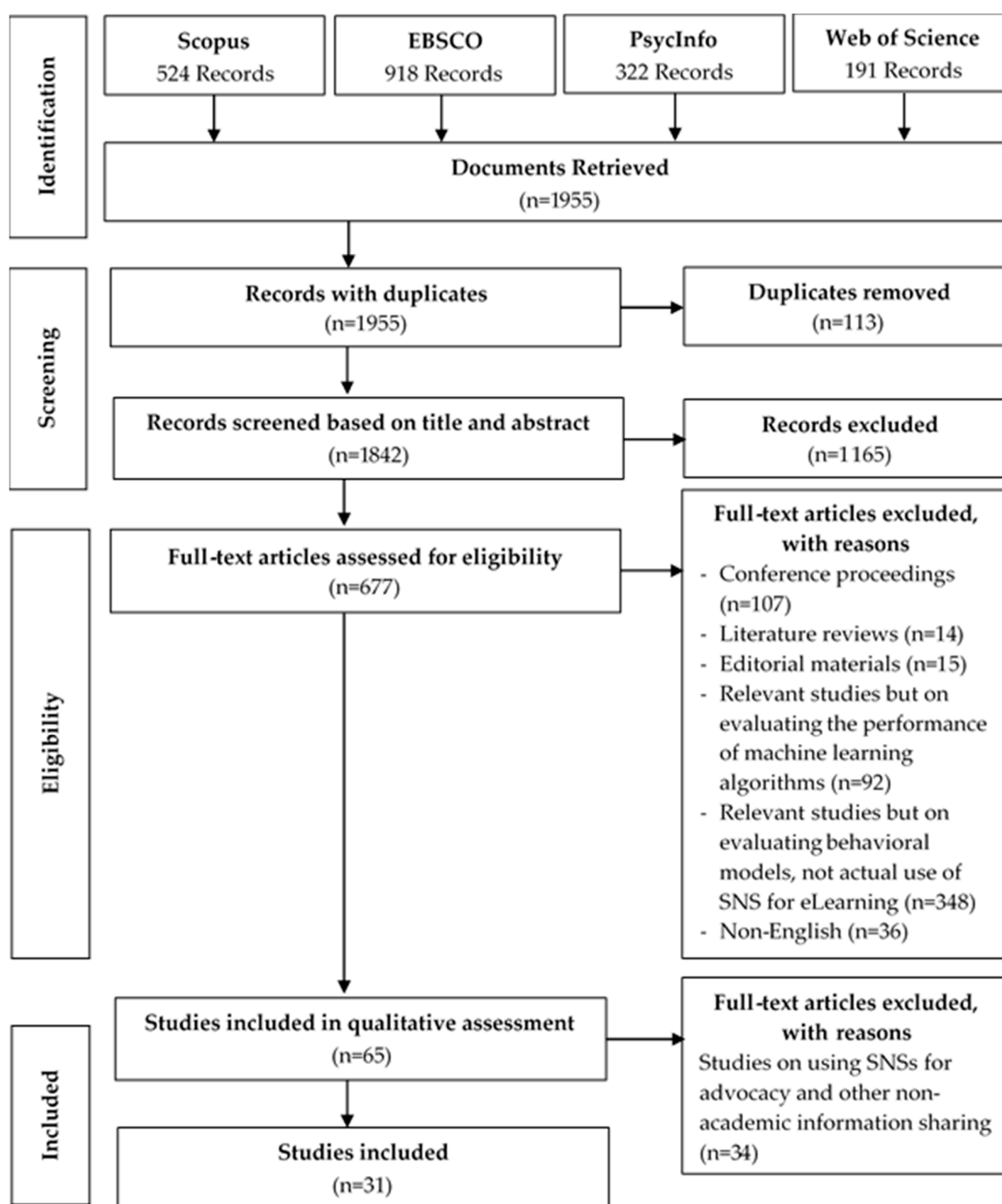


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the systematic literature review.

Table 1. Inclusion and exclusion criteria of the study.

<i>Inclusion criteria</i>
<ul style="list-style-type: none"> • Papers published in English • Papers published from 2011 to 2020 • Papers mainly on social networking sites usage for eLearning • Full-text papers available for download
<i>Exclusion criteria</i>
<ul style="list-style-type: none"> • Articles not written in English • Full text of the papers not available • The research aim of the paper is not clearly defined • Papers that are irrelevant to our research question • Duplicated papers • Titles and Abstracts that deviated from the research aim • Conferences proceedings, literature reviews, and editorial materials • Papers aimed at using SNSs for marketing, advocacy and other non-academic purposes

2.3. Quality Assessment

The authors monitored the planned review procedures meticulously to enhance the quality of this systematic literature review. Primarily, at each stage of the systematic review, the authors ensured the careful planning and allocation of tasks. The first author created an online Mendeley repository to monitor the progress of the review based on preset milestones and to ensure that all tasks complied with the scheduled deadlines. The Mendeley repository was also utilized for noting vital observations, keeping track of the data extraction stages, and other vital information associated with the review. The authors maintained peer-reviewing at every stage of the systematic literature review to enhance the quality of the review. Nonetheless, to obtain a constructive and unbiased assessment on the methodology used in this study, an external expert on eLearning practices with experience in conducting systematic literature reviews was consulted. The expert confirmed that the methodology followed is suited to the study aim.

2.4. Data Extraction

In the data extraction stage, the final stage of the study's PRISMA, 31 studies were considered, and the following contents were extracted from the studies:

- Article
- Number of Citations
- Research Participants
- Location
- SNS Considered
- Purpose of the Study
- Research Design Used
- SNS Functions/Features and eLearning Approach Identified
- Key Finding(s)

3. Results

3.1. Descriptive Analysis of Trends and the Status of the Study on SNS in Education

The trends of the study on SNS and educational practices based on the exported data show the most cited references, the most cited journals, and the publication frequency based on years.

With the advent of COVID-19, as shown in Figure 2, there was a mild increase in publications on SNS and educational practices; from 2017 to 2019, not so many studies cared about SNS and educational practices. However, with the increased patronage of eLearning

tools in 2020, there is an increasing demand for best approaches for sustaining educational practices amid COVID-19. Obviously, the trend will go on until the post-COVID-19 period. On the other hand, the continuous evolution of SNS functionalities necessitates the need for standardized instructional guidelines and best pedagogical practices. Thus, future studies need to revisit the applicability of basic learning theories on upcoming SNS and educational practices. From Figure 3, the most articles contributing to the area were published in Computers in Human Behavior ($n = 23$) and IEEE Access ($n = 6$). Communications in Computer and Information Science ($n = 1$), and Sustainability ($n = 1$) also play a role in the development of the study.

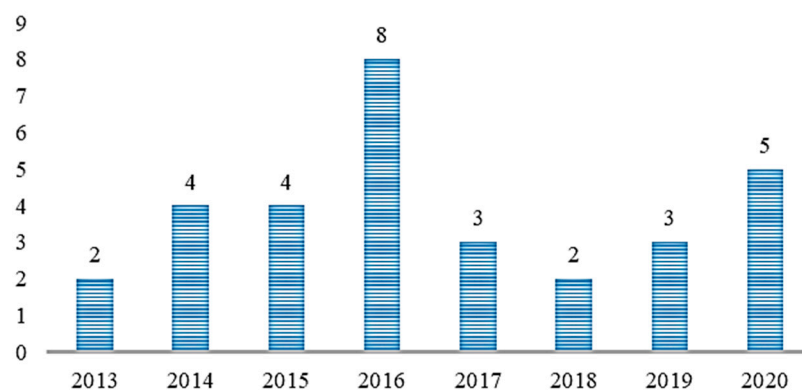


Figure 2. Articles distribution over the years.

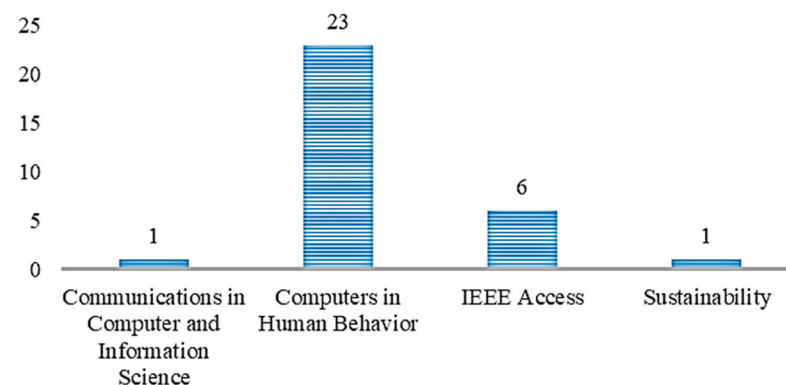


Figure 3. Number of articles per journal.

Based on the exported citation data, as shown in Table 2, we can see that the most cited references are [38] ($n = 304$), [2] ($n = 188$), [39] ($n = 182$), [40] ($n = 113$), and [1] ($n = 106$). The most important references; which received the highest number of citations, were published in Computers in Human Behavior (Table 2, $n = 1638$) in the years 2013, 2014, 2016, and 2017. With the unique challenges posed by COVID-19 coupled with the way studies on SNS are attracting more attention, there is an expectation of more research on best practices for SNS in education.

Table 2. Number of citations per journal.

Journal	Sum of Citations
Computers in Human Behavior	1638
IEEE Access	13
Sustainability	1
Communications in Computer and Information Science	1
Grand Total	1653

3.2. Participants

As shown in Table 3, most of the research participants considered are undergraduate university students [2,6,27,38,39,41–50]. Although few studies collected and analyzed user/system generated data [3,51,52], others considered higher education researchers [5,53], faculty members [7,54,55], and college students [40,56,57] as the research participants. Studies on SNS in education have reached a global level, with most studies coming from Asia [1,2,4–7,39,41,45,47,49,52,56–59], Europe [8,27,43,46,48,50,54,55], and the USA [3,38,40,42,44,53].

3.3. Research Design

Apart from relevant publications on the impact of COVID-19 on educational practices [11–13,18–25] and important literature reviews on the efficacy of SNSs for eLearning [27–33,60], most of the articles included in the present study utilized either web-based or paper-based questionnaires [1,2,4,5,38,39,42,44,47,48,53–58]. Nonetheless, few other studies utilized mixed-study design [45,52], experimental design [43,59], and a manual evaluation of the SNS-based learning contents [3,41,51].

3.4. Most Researched SNSs

As shown in Table 3, the most studied SNSs for educational practices are Facebook [1,2,6,8,27,40,44,46,48,49,53–55,57], Twitter [3,42,45,52], and YouTube [41,51,58,59]. Some of the studies considered SNSs in general [5,38,47,56] while others proposed customized social learning platforms such as ILEARN [43] and an integration of SNS with e-Case Live [7].

3.5. SNS Functions/Features and eLearning Approaches Identified

Most of the studies were aimed at demonstrating the utility of SNSs in supporting the three cardinal factors for effective SNS usage in education: communication, collaboration, and resource/materials sharing. Consequently, apart from the studies that utilized the basic features of the SNSs considered [2,8,39,40,53,57], Facebook groups and similar virtual discussion forums are the most utilized SNS functionalities [6,27,44,46]. Furthermore, in the absence of standardized frameworks for the educational use of SNSs, most of the studies reported the benefits of some intuitive approaches, including Argumentative Knowledge Construction [27,32], Reciprocal Peer Tutoring [49], and Automated Social Learning [43].

3.6. Key Findings of the Studies

The key findings of the studies provide vital considerations for the educational use of SNSs during COVID-19. Categorically, the findings could be transferred to the era of COVID-19 in addressing assorted eLearning challenges, improving students' academic performance [6,38–40,46,50,57], and providing strategies for the sustainable use of SNSs by institutions, students, and teachers. The findings addressed assorted eLearning challenges by either incorporating additional technologies [7,8], improving the accessibility of the learning contents [41,51], or developing a customized SNS platform/framework [43,52]. On the other hand, strategies for the sustainable use of SNSs depend on the defined usage purpose and approach [48,54,55]. Accordingly, some of the key findings have demonstrated the viability of SNSs for the purposes of communication [42,44,54,55], collaboration [1,4,5,53], content creation [8,56], and resource sharing [2,58,59].

Table 3. Information Extracted from the Articles.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[47] C = 2 L = Malaysia SNS = Generic	162 university students familiar with SNSs	To investigate the educational use of SNSs and its influence on students' academic performance in tertiary institutions	Questionnaire	Active learning through discussions, knowledge, and information sharing	Task-technology fit (TTF) and behavioral intentions to use SNSs increase students' engagement in learning activities.
[7] C = 0 L = Taiwan SNS = e-Case Live and SNSs	48 on-job MBA students	To evaluate how integrated services of SNSs with live-streaming can support the participants in case-based learning activities	Questionnaire	SNS's support for live-streaming and case-based learning method	Integration of e-Case Live with SNSs increases students' satisfaction in synchronous and asynchronous discussions, offers a valuable instructional method for a contextual understanding of cases, and enhances student/teacher interaction both in and out of the classroom.
[49] C = 0 L = Malaysia SNS = Facebook	29 university students	To investigate how Facebook-based Reciprocal Peer Tutoring could motivate students' critical thinking	Traces of Facebook posts, statuses, comments from both the tutees and the tutors were collected and analyzed	Reciprocal Peer Tutoring (RPT) strategy using Facebook group pages	Reciprocating the roles of tutee and tutor on the Facebook group enables the participants to gain more understanding of the topic they will discuss during their respective tutor role. The frequency of the questions asked in the group, coupled with the richness and criticality of the discussions involved enhances and shapes the critical thinking pattern of the participants.
[51] C = 0 L = Ecuador SNS = YouTube	91,421 YouTube video clips published by 113 high-ranked universities of the world	To evaluate the accessibility of the sampled YouTube videos based on conformity with the Web Content Accessibility Guidelines (WCAG) 2.1 of the WWW Consortium	Manual assessment of the sampled YouTube videos	Accessibility of the video clips for inclusive learning	87% of the videos failed the basic accessibility conditions, while 17% have associated captions. Improved compliance with the success criterion 1.2.2 (Captions) was identified; only 10% of the oldest videos have captions, as compared to 24% of the newest videos and 18% of the most popular videos.

Table 3. Cont.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[52] C = 1 L = Saudi Arabia SNS = Twitter	Data from 1000s of tweets from the official Twitter accounts of KAU, plus an interview with the accounts' managers	To develop KAU Pandemic Framework; a transparent and efficient SNS-based strategy for sustainable educational practice during the pandemic	Mixed-study design; incorporating quantitative statistical analyses of SNS data with online surveys and qualitative interviews	Tweets for educational administration	KAU Pandemic Framework as a strategic decision-making tool justified a significant contribution of Twitter on six areas: educational sustainability; administrative resilience; positive sentiment; community responsibility; community bonds; and delivery of promised value.
[43] C = 11 L = France SNS = ILEARN	70 students from CESI School of Engineers, France, participated in the ILEARN system, out of which 27 answered the questionnaire survey	To identify the role of web semantics and web2.0 technologies in improving social learning based on users' cognitive experience, emotions, and learning resources	Experimental evaluation of ILEARN based on users' activities, activity type, activity times, and the number of users executing a particular activity out of the 70 participants. Plus Questionnaire	Automated social learning framework based on user emotions and learning resources, plus intelligent recommendation and grouping of learners based on their common interests	The proposed social learning platform (i.e., ILEARN) incorporates web semantics and web2.0 capabilities in providing an automated method of categorizing students based on the similarity in their learning strategies, the strength of their collaborations, and the relevance in the learning resources they access.
[41] C = 43 L = UAE SNS = YouTube	428 university students	To analyze how far educational YouTube videos uphold cognitive features as emphasized in the cognitive theory of multimedia learning	105 videos were collected and analyzed, plus survey on semantics of the videos' Likes/Dislikes	Incorporating cognitive features in video clips	Significant influence was recorded between Video Cognitive Value and four out of the ten investigated features (embodiment, modality, pretraining, and spatial contiguity)
[5] C = 5 L = Malaysia SNS = Generic	1118 higher education researchers	To validate the Technology Acceptance Model (TAM) on SNS for enhanced collaborative learning/authoring among the participants	Questionnaire	Collaborative learning/authoring	Collaborative learning/authoring with SNS improves the researchers' performance. The findings indicated the need for educational institutions to facilitate collaborative learning/authoring platforms.

Table 3. Cont.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[58] C = 61 L = Taiwan SNS = YouTube	117 individuals who used “Guitar Class of Uncle Ma” on YouTube	To investigate the cognitive role that SNSs play on self-efficacy in learning a musical instrument and how it reflects learning satisfaction	Questionnaire	Self-directed learning, learning satisfaction based on SNS video clips	YouTube-based musical classes could foster self-directed learning and learning satisfaction, especially for learners with low level of Internet cognitive failure and high level of self-efficacy.
[2] C = 188 L = Oman SNS = Facebook	215 university students	To develop and test a hybrid model with a better predictive ability in understanding Facebook usage in academia	Questionnaire	Facebook basic features especially resource sharing	Resource sharing is found to be the most influential factor for the adoption of Facebook in tertiary institutions.
[42] C = 26 L = USA SNS = Twitter	483 undergraduate students.	To examine how Twitter can be part of a large classroom based on the notions of community and equitable participation	Web-based questionnaire	Communication, collaboration, and choice of student/teacher interaction	SNS usage attitude shapes student/teacher interaction and students’ engagement.
[50] C = 6 L = Romania SNS = Generic	343 students from six consecutive installments of a Web Application Design course	To predict academic performance based on students’ demographics and interaction within a social learning environment	Data were extracted from the participants’ communications and collaborations on the assorted SNSs in the project-based learning scenario	Project-based learning using SNSs. Contents creation and sharing, communication, and collaboration	A significantly high correlation between students’ final grade and engagement with the SNS tools was predicted with high accuracy.
[54] C = 49 L = Turkey SNS = Facebook	658 faculty members from eight various state universities	To understand the motive behind the participants’ use and disuse of SNSs for educational purposes	Web-based questionnaire	Facebook communication and learning features	Fast and effective communication is the key motive behind the educational use of SNSs, while privacy concerns are the main hindering factors.
[39] C = 182 L = Hong Kong SNS = Generic	348 undergraduate students from eight university faculties	To understand the effect of SNS usage and SNS multitasking on students’ academic performance	Web-based questionnaire	Basic features of the SNSs (Not specified)	There are potential negative impacts of SNSs on students’ social well-being. Non-academic SNS usage and SNS multitasking negatively predicted academic performance.

Table 3. Cont.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[57] C = 33 L = India SNS = Facebook	942 students from five different high schools	To find whether educational affordances and gratifications drive intensive Facebook usage among the participants	Questionnaire	Facebook's basic features and intensive Facebook use	Educational affordances, social uses, and gratifications play significant roles in predicting intensive Facebook usage.
[44] C = 38 L = Canada & US SNS = Facebook	87 university students	To understand the impact of instructor-guided usage of Facebook on learning activities	Web-based questionnaire	Facebook group/page	Instructor-guided Facebook class improves students' interest in the course material and shapes perceived value in the course content and the student/teacher interaction.
[3] C = 17 L = USA SNS = Twitter	400 tweets on snowstorm-related contents were selected from public safety organizations	To analyze the quantity and quality of the instructional tweets	The contents were compared with the available instructional content provided on the official websites of the organizations	Twitter feeds and content sharing	There is increased utilization of SNSs by both authorities and the public in sharing and accessing instructional information during crises.
[56] C = 55 L = Hong Kong SNS = Generic	186 secondary school students	To find how students use SNSs in and outside school	Questionnaire	Content creation	The study found that students create more contents in school. They access and share more contents outside of school.
[46] C = 82 L = Serbia SNS = Facebook	139 university students	To find the relationship between using educational Facebook usage and students' academic performance	Two Facebook groups were created; one for educational use and the other for social use	Facebook's group features	Frequency of educational Facebook use is positively related to students' academic performance.
[48] C = 78 L = Serbia SNS = Facebook	226 university students	To investigate students' attitudes as well as perceptions toward social and educational Facebook use	Questionnaire	Communication, collaboration, and resource/material sharing	Although students use Facebook mainly with school-related peers, social usage is dominant over educational. Ease of communication, collaboration, and resource/materials sharing enhances educational use.

Table 3. Cont.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[1] C = 106 L = Taiwan SNS = Facebook	387 participants from a Facebook page	To examine the potential educational and non-educational value of Facebook and compare its educational utility with other media	Web-based questionnaire	Resource sharing, Facebook posts, and collaboration	Educational use of Facebook is higher among closely related classmates, ahead of other common motives. Facebook outperformed other e-learning platforms in terms of convenience in resources sharing, improved students, and student/teacher interactions.
[59] C = 13 L = Taiwan SNS = YouTube	15 students in an English learning class (the class spanned 10 weeks)	To demonstrate how SNSs enable mainstream English songs to be used as teaching material	Experimental	Language learning using YouTube videos, Audio and textual transcriptions	YouTube can serve as an effective and flexible medium for promoting ubiquitous language learning with enhanced students' motivation.
[40] C = 113 L = USA SNS = Facebook	283 college students of Asian origins; South Korea and China	To examine the effects of ethnic SNS use and individual differences on acculturative stress and psychological well-being	Questionnaire	Facebook's basic features (Not specified)	The participants that used Facebook exhibit lower acculturative stress and higher psychological well-being. While individual differences are significantly related with psychological well-being and acculturative stress, ethnic SNS usage is positively related with acculturative stress.
[6] C = 1 L = Taiwan SNS = Facebook	50 university students	To investigate the educational Facebook use and how it affects students' academic performance and engagement	Assessment of students' Facebook discussions and interaction	Facebook Group	Facebook fostered student/teacher interaction, collaboration, and knowledge sharing. While introvert students are likely to benefit more, participation frequency is positively related with students' academic performance.
[53] C = 13 L = USA SNS = Generic	382 research assistants	To examine the effect of geographical barriers of graduate students on their SNS usage in communication, information retrieval, and relationship maintenance	Web-based questionnaire	Basic SNS features (not specified)	There exist mild effects of physical displacement of the participants on their uses and gratifications of SNSs. Relationship maintenance via SNSs is not always influenced by the students' geographic and physical displacements.

Table 3. Cont.

Article/Number of Citations (C)/Location (L)/SNS Considered	Research Participants	Purpose of the Study	Research Design	SNS Functions/Features and eLearning Approach Identified	Key Finding(s)
[38] C = 304 L = US & Europe SNS = Generic	875 university students; USA ($n = 451$) and Europe ($n = 406$)	To investigate the effect of SNS multitasking on students' academic efficiency and productivity	Web-based questionnaire	Multitasking in using SNSs	The study findings provided valuable cautionary insights on the negative effect of disruptive SNS multitasking on students' Grade Point Average.
[8] C = 17 L = Cyprus SNS = Generic	74 students in three study cycles; Cycle 1 ($n = 4$), Cycle 2 ($n = 27$), and Cycle 3 ($n = 43$)	To demonstrate the use of SNSs in collaborative artifacts construction	Design-Based Research (DBR)	Content creation, reporting, and presentation, resource sharing, and collaboration	The digital nativity of students enables a quick grasp of the basic functionalities found in a new SNS, and students with higher technology skills are more active in content creation using SNSs. Supplementing with other technologies (such as Dropbox) enhances sustainable SNS use.
[45] C = 67 L = Singapore SNS = Twitter	41 undergraduate students, expert interviewees	To find whether SNSs could resolve the dilemma of non-participating students in a class	Mixed-study design	Pedagogical tweeting, collaborative learning, content creation, and knowledge sharing	The paper discussed the challenges ahead and proposed four hypotheses on effective deployment of SNSs that will improve user participation.
[55] C = 27 L = Turkey SNS = Generic	412 pre-service teachers	To investigate pre-service teachers' pattern of SNS usage and its effects on their academic productivity	Questionnaire	Communication, collaboration, and resource/material sharing	The results showed that the purpose and approach in using SNSs define the benefits or harms on the educational process. It is also found that communication is the most favored function of SNSs among the participants.
[27] C = 33 L = Germany SNS = Facebook	249 university students in three sub-studies; Study 1 ($n = 40$), Study 2 ($n = 81$), and Study 3 ($n = 128$)	To investigate the influence of scripts, group awareness support, and individual preparation on argumentative learning using Facebook	Experimental (three sub-studies)	Facebook group	In all the sub-studies, all the participants independent of intervention (either scripts, group awareness support, or individual preparation) learned through argumentative SNS discussions.
[4] C = 82 L = Taiwan SNS = Google+	321 university students	To experiment on a collaborative learning approach using SNSs in a ubiquitous learning context, and examine SNS usage attitude, effects, and the influential factors based on a modified TAM	Questionnaire	Collaborative learning	The experimental procedures employed in the study demonstrated the value of Google+ in supporting a collaborative learning approach. Findings from the modified TAM indicated that the acceptance of the SNSs improves learners' attitude and intention to further use the SNSs for learning activities.

4. Discussion

A systematic synthesis of the existing literature demonstrates the utility and effectiveness of SNSs in supporting educational practices. The flexibility in self-directed learning with SNSs provides meaningful collaborations between students/teachers and a successful mastery of the learning contents. Although SNSs do not have a standardized framework for pedagogical approach, instructors and practitioners have reported careful intuitive approaches that provide beneficial instructional decisions on using these technologies. Apart from the common self-directed learning capabilities of SNSs, some of the novel educational approaches that studies have explored for effective academic communication, collaboration, and resource sharing using SNSs includes Argumentative Knowledge Construction [27,32], Reciprocal Peer Tutoring [49], and Automated Social Learning [43].

The sustainable educational use of SNSs by institutions, teachers, and students requires optimal monitoring, motivation, and planning [8,61]. Previous literature reviews highlighted some of the best practices and strategies for the sustainable educational use of SNSs. For instance, Tsovaltzi [27] presented the collective results of three experimental studies on the effects of instructional design, learning processes, and personality on argumentative learning on Facebook. The three studies have indicated the value of Facebook in supporting knowledge co-construction through argumentative discussions. Lin [28] highlighted seven best practices for improving the effectiveness of crisis communication and learning using SNS. The seven best practices are a full integration of SNSs into decision making and policy development, utilizing SNS affordance in sourcing credible information, monitoring misinformation, active engagement in online dialogue, moderating the speed of message update, owning the hashtag, and cooperating with sister organizations. Tess, Chiroma, and Vollum [29–31] described the utility and effectiveness of SNS in education and cautioned the negative effects of disruptive SNS use on students' performance. Zhang [60] discussed the trend of studies on SNSs in education based on quantitative data extracted from the Web of Science and identified how the research topic is growing and changing relatively fast. Kirschner [32] reviewed the results of four studies and identified the SNS's support for knowledge co-construction through argumentative discussions independent of learners' preparation and other interventions. Recently, Greenhow [33] provided guidelines for US higher institutions based on a literature review and the authors' own experiences of integrating SNSs into traditional online teaching. In the forgoing reviews, the key motivations highlighted for the sustainable use of SNSs in education include the possibility of personal profiling, socializing, content creation, and relationship building.

As shown in Table 3, the key findings described the participants' attitudes, the use of SNS-supported educational strategies, and the latter's impacts on educational activities. Studies that focused on effective strategies indicated how using SNSs enhances active learning, improves academic performance, and helps students and teachers to stay connected while apart. For instance, Rice [3] explored the convenience of tweets on sharing instructional information during crises. They analyzed 400 tweets from four Twitter accounts of public safety organizations in Lexington, based on a quantity and quality assessment of the instructional information shared during multiple winter storms. The study showed the value of SNSs in disseminating reliable and valuable information during a crisis. Menkhoff [45] employed a mixed study design to describe the value of SNSs in improving student engagement. They surveyed 41 undergraduate students enrolled in a Knowledge Management (KM) course at Singapore Management University. The study demonstrated how pedagogical tweeting could promote self-mediated learning and engage non-participating students.

Challenges associated with the sustainable deployment of SNSs in education could be addressed by either incorporating additional technologies [7,8], improving the learning contents [41,51], or developing customized a SNS platform/framework [43,52]. Al-Youbi [52] conducted quantitative data analyses and a qualitative interview on hundreds of tweets from the official Twitter accounts of King Abdulaziz University (KAU) and the accounts' managers, respectively. They developed the KAU Pandemic Framework to assess the

efficiency of SNS-based strategies toward sustainable educational practice during the pandemic. The Framework, as a strategic decision-making tool, demonstrated the significance of Twitter in supporting a sustainable educational practice during pandemics. Khaled [43] developed an automated social learning platform called ILEARN and conducted an experimental evaluation of the system with 70 students from CESI School of Engineers, France. ILEARN demonstrated the importance of incorporating web semantics and web2.0 technologies into SNSs. ILEARN provides an automatic categorization of students based on the similarity of their learning strategies, the strength of their collaborations, and the relevance of the learning resources they access. Some of the instances on the importance of improving the accessibility of the learning contents can be seen in the works of Shoufan [41] and Acosta [51]. Shoufan [41] described how improving the cognitive features of educational YouTube videos could support students' learning. Moreover, Shoufan [41] analyzed how viewers' ratings could define the Video Cognitive Value of 105 sampled educational YouTube videos. The result showed that only four out of ten investigated features are significant for Video Cognitive Value (pretraining, modality, spatial contiguity, and embodiment). Similarly, Acosta [51] conducted an accessibility evaluation of 91,421 YouTube videos published by the 113 best universities in the world. The findings showed that 87% of the sampled videos do not comply with the basic accessibility requirements of Web Content Accessibility Guidelines (WCAG) 2.1 of the World Wide Web Consortium. Compliance with the success criterion 1.2.2 (Captions) has improved over the years; 24% of the newest published videos have captions, compared with 10% of the oldest videos and 18% of the most popular videos. The practice of integrating complementary technology with SNSs for sustainable educational practice can be seen in the work of Liu [7], in which a live-streaming system was integrated with SNSs. The result of the study demonstrated how supplementing eLearning tools with SNSs helped 48 on-job MBA students with increased satisfaction in synchronous and asynchronous SNS discussions, offered a valuable instructional method for a contextual understanding of cases, enhanced students' engagement, and increased the interaction between teachers and students both in and out of the classroom.

In the literature, the purpose of, and approach to, using SNSs defined the benefits or harms on the educational process [48,54,55]. Reciprocal Peer Tutoring [49], and argumentative SNS discussion [27] are among the notable educational approaches reported, while the main purposes identified include communication [42,44,54,55], collaboration [1,4,5,53], content creation [8,56], and resource sharing [2,58,59]. Furthermore, the use of SNSs is reported to have a significant influence on the success of SNS deployment in terms of students' academic performance [6,38–40,46,50,57]. However, despite the utilization of SNSs for educational purposes, privacy concerns are among the factors that hinder their usage [54].

Academic institutions must understand the compatibility of the technological functions with the actual requirements of the educational task to be supported before new or continued utilization of SNSs in education. Although the need for rigorous research to understand the compatibilities was not reported in the previous studies, examining the stated compatibilities improves the active learning of students and enables them to efficiently share information and knowledge, and engage in educational discussions [4,6,47]. Furthermore, there are additional factors that shape the utilization of technological functions in relation to the educational task and usage context. For instance; Lu [56] found that students consume and share more content outside of school and create more in school. Dhir [57] examined how educational affordances and gratifications drive intensive Facebook usage among 942 students from five different high schools in India. The study found that content uses and gratifications did not play significant roles in predicting intensive Facebook use, while process, technology, and social uses and gratifications did. Similarly, Hsu [6] examined how Facebook group functionalities motivate learning and facilitate students' discussion. They found a positive relationship between students' participation frequency

in the Facebook group and their academic performance. In addition, introvert students in the physical world are likely to benefit more in learning from Facebook group discussions.

With the foregoing discussion, apart from the benefits identified in using SNSs for educational practices, it is obvious that SNSs are suitable in the era of COVID-19 because their availability and ubiquitous usage among students and teachers warrant no need for training or assessment of user readiness. Studies have shown that SNSs could enhance the traditional cognitive eLearning process with social collaborations. For instance; Eid [62] conducted a cross-sectional survey to examine the impact of various SNSs on learning performance among 308 university students in Saudi Arabia. The result of the study indicated significant positive relationships between students learning with active SNS engagement and entertainment. Hung [63] explored the impact of supplementing a face-to-face course with SNS in a group of 67 university students enrolled in four face-to-face courses. The participants expressed increased feelings of social connectedness and stronger learning experiences in the classes supplemented with SNSs. They also suggested ways of addressing learner difficulties on the educational use of SNSs. Dogoriti [64] examined the perception of Moodle-based English learning students in Greece, on the impact of supplementing the LMS with Facebook. The results suggested that almost 70% of the students expressed an enhanced sense of collaborative learning and peer engagement while using Facebook as an adjunctive informal learning environment.

5. Conclusions and Recommendations

This study systematically reviewed the existing literature on eLearning with SNSs and illustrated how current educational challenges could be addressed by transporting evidenced practices of eLearning with SNSs to the era of COVID-19. In consequence, it is found that, despite numerous studies on eLearning tools, the power of SNSs and their potential for collaborative self-regulated learning remains under-investigated. Accordingly, eLearning studies largely remain faithful to LMSs, and that can restrict exploring the potential of SNSs as learning tools and collaborative learning in general. The reviewed studies have shown that SNSs can supplement traditional LMSs by helping students to meet pedagogical objectives through the creation of contextual learning outcomes. Most notably, SNSs improve meaningful students' engagement, enhance collaborative learning, and help in bridging the gap between knowledge and competency in individual or team work. In addition, SNSs provide motivation and flexibility for students' questioning and responses, respectively. SNSs also support sustainable learning, as they align with students' preferences and learning cultures. Conclusively, apart from the benefits identified in using SNSs for educational practices, SNSs are suitable in the era of COVID-19 because their availability and ubiquitous usage among students and teachers warrant no need for user training or assessment of user readiness. The main difference between the present study and other published literature reviews is that while other studies focused on pointing out the advantages of using SNSs in education, this study identified the current eLearning challenges due to COVID-19 and highlighted the suitability of SNSs in addressing them in connection with sustainable education. We hope that the results of this systematic literature review can help both institutions, teachers, and students to harness the efficacy of SNSs' usage in curtailing the present and future eLearning challenges for a sustainable educational practice.

Nonetheless, like other researches, some of the inherent limitations of the present study include the fact that we have only considered articles published in English. This might have prevented us from reviewing excellent studies published in other languages. Secondly, the search criteria were limited to only four scientific databases and the few search terms chosen. Searching within additional databases can be performed to explore other relevant studies. Thirdly, we reviewed only published full-text journal articles. Hence, our results are constrained by the findings of the included articles. Lastly, the year boundaries were limited to 2011–2020. The future agenda will be to expand the search criteria to include all scientific databases for more comparative findings. In addition, future studies

can consider other types of papers, such as international conference proceedings, books, and so on. Consequently, to build on the reviewed studies, empirical studies involving multiple data sources and expert interviews can be conducted.

Author Contributions: Conceptualization: A.A.L., A.S.S., N.C. and Y.H., methodology: A.A.L., writing—original draft preparation: A.A.L., A.S.S., and Y.H., writing—review and editing: A.A.L., and N.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data sharing is not applicable to this article.

Acknowledgments: The authors would like to acknowledge Dahiru Abdullahi of Nursing Education Department, Kano School of Nursing, for the expert assessment of the methodology used. The authors would also like to acknowledge the Editorial office for their support and the Reviewers for their insightful comments.

Conflicts of Interest: The authors declare no conflict of interest.

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