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# Augmented Reality-Based English Language Learning: Importance and State of the Art

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**Abstract:** Augmented reality is increasingly used in the educational domain. However, little is known concerning the actual importance of AR for learning English skills. The weakness of the English language among English as a foreign Language (EFL) students is widespread in different educational institutions. Accordingly, this paper aims at exploring the importance of AR for learning English skills from the perspectives of English language teachers and educators. Mixed qualitative methods were used. To achieve the objective of this study, 12 interviews were conducted with English teachers concerning the topic under investigation. Second, a systematic literature review (SLR) that demonstrates the advantages, the limitation, and the approach of AR for learning English was performed. This study is different from other studies in using two methods and conducting comprehensive research on the importance of AR in improving English language skills in general. Thus, the study concluded that AR improves language skills and academic achievements. It also reduces students' anxiety levels, improves students' creativity, and increases students' collaboration and engagement. Moreover, the students have positive attitudes towards using AR for learning the English language. The findings present important implications for the integration and development of AR for learning.

**Keywords:** augmented reality; English language skills; semi-structured interviews; systematic literature review

## 1. Introduction

Augmented reality (AR) reflects a physical real-world environment that has been augmented or enhanced by adding virtual computer-generated information to it. Cipresso et al. state that AR is a new technological system that entails adding virtual objects to the real world in real time throughout the user's experience [1].

AR contains an integration of computer-generated data, namely, graphics, audio, and video with the real world [2]. It supports and reinforces reality by presenting information that is neither recognized by individuals' imagination nor identified by their cognitive process in normal circumstances [3]. Recently, the popularity of augmented reality has experienced a rapid increase, particularly for academic purposes. Within this context, it is considered one of the most revolutionary inventions [4]. According to Han et al., the reason behind its popularity lies in providing a mediated conception of the factual world by combining it with computer-generated content [5].

Augmented reality has various uses in different fields, such as [6–8] psychological treatment, manufacturing, medicine, robotic, military, robotic, customer design, telerobotic,

and maintenance and repair applications. The authors of [9,10] argue that AR technology has many potential applications in several fields, such as engineering and manufacturing, medicine, entertainment, and education [10]. Concerning the learning domain, it can be used for entertainment, edutainment, or learning by increasing the user's interaction with and perception of the real world [11].

Turning now to unravel the importance of augmented reality in education, augmented reality is of paramount importance in education because it permits the real world to be integrated with virtual teaching materials, which, in turn, allows the learner to acquire information by discovering, which, in turn, has a positive impact on the learner [12]. As Dunleavy and Dede put forward, augmented reality builds a positive learning environment and enhances the principles of constructive learning [13].

There have been a large number of studies manifesting the value presented by augmented reality in education. The most prominent one lies in promoting enhanced learning achievement. However, the disadvantage of augmented reality is manifested in the technical problems faced by its users [14].

The first mainstream augmented reality application game for increasing general public interest refers to the invention of Pokémon in 2016 [15]. As for the education context, Juan et al. invented an educational augmented reality game for facilitating the acquisition of vocabulary items among children. Such games enable children to spell words correctly. It requires them to place the markers constituting each alphabet in their correct place [16]. Along similar lines, mobile-based applications help in creating an effective English environment for EFL students because they play a pivotal role in facilitating their English language acquisition [17]. Moreover, a mobile-based AR application improves students' English vocabulary and creates a positive and attractive learning atmosphere [18].

The literature has long discussed the effectiveness of combining augmented reality technologies and applications with educational content. According to Kesim and Ozarslan, the inclusion of augmented reality in automated applications promotes the attractiveness and effectiveness of learning and teaching among learners [11]. Accordingly, the aim of the present study lies in qualitatively exploring the value of AR for learning English.

This paper focused on the viewpoint of the teachers and the information cited in the literature. It did not consider the perspective of the students. Furthermore, the study is concerned with the impact of augmented reality on improving English language skills such as speaking, reading, and listening. However, it did not address the importance of augmented reality in improving writing skills.

## 2. Literature Review

### 2.1. Augmented Reality

The notion of augmenting the real world with virtual data was first employed by a wide range of applications in the late sixties and seventies. Since the nineties, augmented reality has been employed by some big firms and corporations for training and visualization [19]. It is worth mentioning that augmented reality is attributed as having the following peculiarities: combining the real world with virtual, interactive, and registering in 3D. Furthermore, it can either add or remove physical objects out of sight and substitute them with other content [20].

The effectiveness of augmented reality technology stems from the fact that it enables the loading and merging of virtual objects into the real world, such as photographs, video, text, 3D models, sound, and so forth. It enables its users to connect the real and virtual worlds. Generally speaking, augmented reality applications seek to offer their users a medium that is close to the real world [21]. Therefore, augmented reality technology has unfailingly garnered attention from scholars because it has led to an evolution of technology [22].

### 2.2. The Use of Augmented Reality in Education

Augmented reality is considered one of the most modern information visualization technologies. Augmented reality technologies are used in the following areas: tourism; social interaction, such as entertainment and games; communication; purchase and sale areas; education [23]. Nowadays, the advent of mobile devices and personal computers has enabled augmented reality concepts to be used in traditional educational environments such as schools and universities [19]. AR is mainly consistent with constructivist and situated learning theory because it places the students within a real-world social and physical context while scaffolding, guiding, and facilitating metacognitive and participatory learning processes, namely, peer coaching, authentic inquiry, active observation, and reciprocal teaching [13].

AR promotes the effectiveness of learning because it relies heavily on visualization and realization of the concepts; thus, it increases students' engagement by giving them the room to explore either complex phenomena or abstract concepts [13,24].

AR educational use has been examined in which various researchers concluded that AR applications might improve learning effectiveness and motivation and promote the learning process [25,26]. There are a large number of augmented reality applications and tools that are designed for teaching and learning purposes [27].

However, there are some challenges in applying augmented reality applications and systems that are summarized into pedagogical, technological, and learning matters concerning the execution of augmented reality in education. According to Billinghurst, there are grand challenges in AR applications that are manifested in interaction, tracking technologies, displaying, and furthering the depiction of AR. For instance, augmented reality applications might lead the learners to be cognitively overloaded with the huge amount of information they face, the complicated tasks they have to accomplish, and the various technological devices they have to use [28].

### 2.3. Augmented Reality in English Learning

Even though augmented reality is still in the early phases concerning the educational domain, a variety of researchers indicate that augmented reality enriches the school curriculum [29]. For example, augmented reality might promote students' motivation towards learning English, particularly reading skills [30], and augmented reality offers the capabilities of greatly promoting the educational system. Augmented reality is considered an effective tool that facilitates the process of learning English and improves students' motivation [31].

However, Lee conducted a study on the impact of augmented reality on improving reading comprehension among students and deduced that print reading was more beneficial than augmented reality or digital reading [32]. On the other hand, Rau et al. opine that using the applications of augmented reality might improve reading and the teaching of reading skills among students [33].

Barreira et al. [34] have indicated that children who were exposed to augmented reality games mastered the language as opposed to their counterparts who used only traditional teaching methods, which, in turn, indicates the effectiveness of AR in the educational domain [34].

Küçük et al. investigated the effectiveness of augmented reality in changing the attitudes, cognitive loads, and achievements of English as a foreign language (EFL) students. The results concluded that secondary school students are satisfied with using augmented reality for learning English. Their anxiety level was reduced after using AR. Interestingly, they showed a positive attitude toward using augmented reality in learning English [35].

Hsu conducted a study on the impact of augmented reality educational games on promoting English vocabulary items among third-grade students. Each system relies on a different approach: the first one is tailored depending on self-directed learning, while the second is tailored depending on task-based learning. The findings revealed that the students using the self-directed or task-based augmented reality educational game system

had similar and high learning effectiveness, but the students employing the self-directed system showed higher flow experience [36].

Lakshmi and Suresh investigated the extent of the improvement in English language skills among students by using AR applications. The study presented the recent developments and apps used in learning English, such as 3DBearAR, which is an app that aims at improving students' reading and speaking skills; catchy words AR, which is a game that integrates learning with movement in which the students are required to walk and catch the letters; Jigspace, which is an application that enables the students to look at jig and read the text that comes with it it aims at improving the reading skills of the students and enhancing their presentation skills; Google Translate, which is an application that enables students to translate the content from one language to another, which improves the vocabulary knowledge of the students. Moreover, the study deduced that AR plays a pivotal role in improving learning performance (Lakshmi and Suresh 2020).

Chang et al. [37] examined whether the learning performance of EFL students can be improved by using AR in a situational context. The study validated the learning performance of the experimental group of students according to the (ARCS) model which stands for attention, relevance, confidence, and satisfaction. The findings revealed that the experimental group who were exposed to AR performed better than the control group who were exposed to the traditional teaching method. Therefore, the learning performance improved significantly, and EFL students showed positive feedback towards using AR in the classroom. More importantly, the results indicated that AR enhances students' concentration on speaking English as a foreign language. Moreover, AR improved students' confidence in learning English due to their exposure to real-life scenarios. Furthermore, AR enhanced students' satisfaction [37].

Geng and Yamada developed and designed an AR learning system relying on AR animations and image schema to confront the challenges concerning the acquisition of Japanese compound verbs. The study addressed the impact of the developed AR-based language learning system on the cognitive load and learning performance of paper-based image schema materials and the AR learning system. This study tackled the correlation between cognitive load and learning performance. The findings revealed a significant improvement in performance among the students on post-tests in terms of knowledge retention; thus, the study concluded that the AR learning system was more efficient. Nevertheless, the findings revealed that no significant difference in the perceived cognitive loads existed between the above-mentioned learning methods [38].

## 3. Methods and Procedures

The methods and procedures for this work cover the types of data collocation as well as analysis techniques used, Figure 1 shows the steps of the procedure.

### 3.1. Data Collection and Sample

Our work data has two methods, the interview and the obtaining the data from other published work through the systematic literature review.

### 3.1.1. Semi-Structured Interview

The study used two methods. To gather qualitative data, semi-structured interviews were used. The study developed 8 interview questions developed according to previously reviewed literature to collect detailed insights from English teachers and educators (Appendix A). The characteristics of the participants are illustrated in Table 1 where the total numbers interviewed were 12, 8 females and 4 males, with different qualifications: 4 holding doctorates, 4 holding masters, and 4 holding bachelors. The minimum experience was 5 years and the maximum years of experience was 15 years. The table illustrated below presents the characteristics of the participants, such as their gender, age, academic level, years of teaching experience, and grade levels i.e., the level of educational program that teachers provide for teaching students.
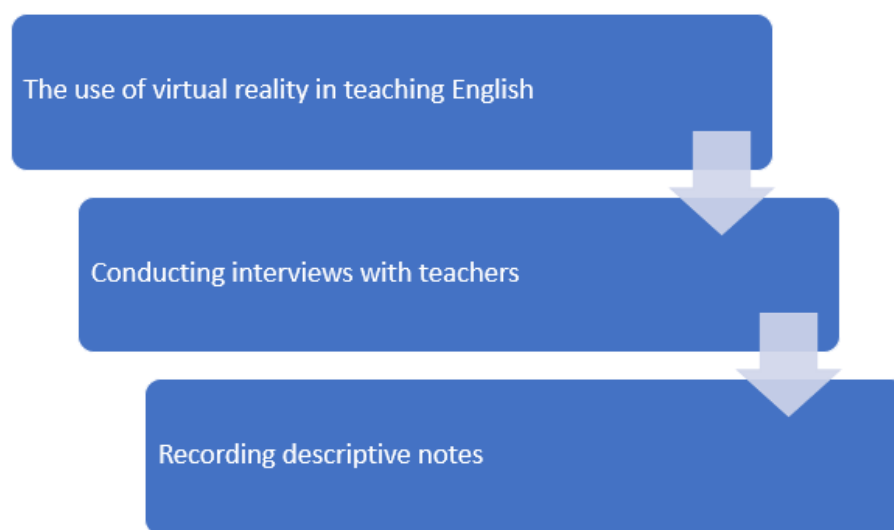
**Figure 1.** The diagram shows the steps of the procedure.

**Table 1.** Characteristics of the participants.

| No. | Gender | Age | Academic Level | Years of Teaching Experience | Grade Levels |
|-----|--------|-----|----------------|------------------------------|--------------|
| 1 | Female | 30 | Bachelor | 7 | Elementary |
| 2 | Female | 33 | Bachelor | 10 | Elementary |
| 3 | Female | 27 | Bachelor | 5 | Elementary |
| 4 | Female | 28 | Bachelor | 6 | Elementary |
| 5 | Male | 35 | Master | 11 | Secondary |
| 6 | Male | 38 | Doctorate | 13 | Secondary |
| 7 | Female | 40 | Master | 15 | Secondary |
| 8 | Female | 45 | Master | 16 | Secondary |
| 9 | Male | 40 | Doctorate | 14 | Secondary |
| 10 | Male | 38 | Doctorate | 12 | Secondary |
| 11 | Female | 42 | Doctorate | 10 | Secondary |
| 12 | Female | 43 | Master | 10 | Secondary |

To gather qualitative data, the study used semi-structured interviews. The questions of the interview are included in Appendix A. The participants were required to express their opinions about the impact of AR on learning English. As McIntosh and Morse put forward, a semi-structured interview is tailored to ascertaining subjective responses from participants concerning a specific situation or phenomenon they have experienced [39]. The questions of the interview aim at identifying the thoughts, ideas, perspectives, and feelings of the respondents.

The paper interviewed 12 teachers, 8 females and 4 males from different schools: Shamakh Elementary School (4), Al Eskan Mixed Secondary School (4), and Al Mansourah Mixed Elementary School (4).

It should be noted that the current study seeks to collect a wide range of perspectives from English teachers from different schools in Jordan to pinpoint the AR dimensions that affect the process of learning English.

The interviews were carried out from 9 August to 13 August 2021. Then, they were recorded with a recording device. To elicit in-depth information concerning the topic under investigation, written notes were taken from the subjects of the study. To guarantee a better understanding of the subject matter, the study interviewed participants who have at least five years of experience in teaching English.

The study used purposeful, non-probability, and judgmental sampling. Convenience sampling was used in the interviews to achieve the objective of the study, which sought

to interview English teachers who had more than five years of experience in teaching to answer the questions adequately and to ensure their full comprehension of the importance of AR in learning English. The duration of the interviews ranged from 15 to 20 min.

### 3.1.2. Systematic Literature Review

The second method is a systematic literature review (SLR) that relies on the guidelines of Kitchenham and Charters [40] for evaluating, identifying, explaining, and analyzing available data to address specific questions of the study concerning the value of AR technology for learning English. The SLR process is classified into four primary phases: the first one is so-called the formulation of a concentrated research question. Second, the conducting phase is concerned with determining previously conducted studies and selecting primary studies. Third is the determination of inclusion and exclusion criteria. Fourth is the assessment of the quality of the selected studies. The following section of this paper goes into greater detail about each of the aforementioned phases.

### 4. Research Questions

For identifying SLR research questions, there are various numbers of standards to be considered before carrying out the SLR process, namely, population, intervention, comparison, and results as indicated in Table 2.

**Table 2.** SLR on AR in education.

| Criteria | Scope |
|---|---|
| Population | Papers that suggest an approach, a framework, a model, and a technique in teaching and learning English by employing AR. |
| Intervention | Present works that address specific issues in English teaching and learning, and suggest future work using AR. |
| Comparison | Advantages and limitations of each suggested work by employing AR in teaching and learning English. |
| Results | Elements in teaching and learning English by employing AR and suggested work that can be employed to enhance the effectiveness of learning English. |

The aim of using SLR lies in analyzing how and where AR has been used for learning English skills in general. Moreover, the study aims to identify the development of AR applications along with pinpointing their advantages and disadvantages. Accordingly, this study seeks to answer the research question illustrated in Table 3. The analysis of the previous studies did not enable the researchers to find an answer to the posed questions because they concentrated on the impact of using AR applications on improving reading comprehension and vocabulary knowledge among students in particular. However, the related studies might be used as a framework for more comprehensive studies on the process of learning English language skills in general. This study is different because it is based on teachers' perceptions and knowledge concerning the implementation of AR in the classroom for improving students' reading comprehension and vocabulary knowledge (Figure 2).

**Table 3.** Reflects both the questions and the motivation of the study for the systematic review.

| Questions | Motivation |
|---|---|
| RQ1: What are the benefits of augmented reality in improving reading comprehension? | This question seeks to pinpoint how AR technology has been employed for improving reading comprehension. |
| RQ2: What are the benefits of augmented reality in improving vocabulary knowledge? | This question aims at unraveling the advantages of augmented reality in improving vocabulary knowledge. |
| RQ3: What are the benefits of augmented reality in improving grammar knowledge? | This question intends to mention the benefits of augmented reality in improving grammar knowledge. |
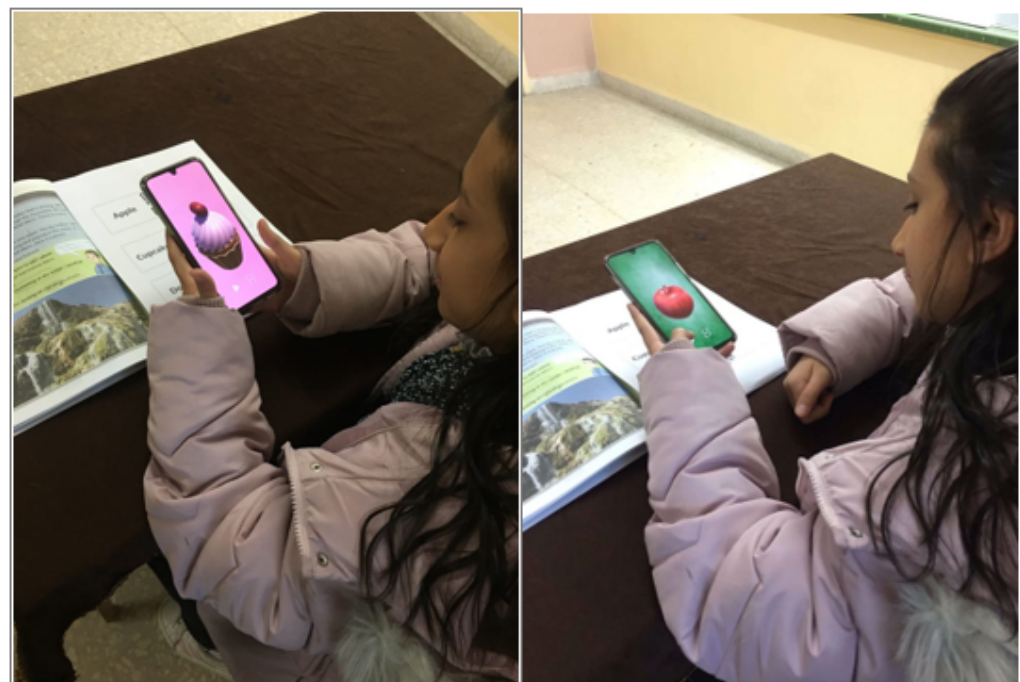


**Figure 2.** Student learns using our augmented reality system.

**A—Search Strategy**

For determining the strings of the search, the use of AR applications and games for improving English skills was examined. The study used the following steps: the first involved searching online websites and database libraries for keywords, some of which were provided in the related paper, as shown in Table 4. Second, search results were recorded. Third, academic papers were classified in terms of types of publication and academic papers, such as journals, theses, conferences, and so forth with consideration to the exclusion criteria.

**Table 4.** Search keyword code.

| | Detailed Keyword |
|---|---|
| K1 | The effectiveness of AR application in learning English. |
| K2 | The impact of AR on improving English language skills. |
| K3 | Issues in learning English, such as approach, model, technique, and frameworks using AR technology. |
| K4 | AR application in teaching and learning English. |

**B—Inclusion and Exclusion Criteria**

The papers that were published from 2015 to 2020 were taken into consideration. The studies that touched upon the importance and the role of AR applications in improving English language skills were selected. On the other hand, all the papers that are unrelated to the current topic under investigation, short papers, non-academic publications, papers that are not written in English, and papers that do not follow the indicated keywords were excluded.

### C—Selection Procedure

First, the papers were taken from "Google Scholar" studies in which a wide range of studies appeared. To serve the purpose of the study, five recent studies on the topic under investigation were chosen. A total of 62,700 studies were found, while 7 papers were used in this analysis. The study chose the papers that had an answer for each question in the study.

### D—Data extraction

After selecting the papers, the researcher read the entire work to elicit the information that answers the research questions.

## 5. Quality Assessments

As Vilela et al. point out, quality assessment enables the reviewer to provide guidance on the chosen studies, maximize validity, and minimize bias [41]. The current study employed quality assessment for identifying subgroups of the primary papers. For validating the quality of the chosen articles, the study developed a few questions as a guideline for selecting related articles for the current. Such a phase is essential for ensuring that only valid, related, and relevant articles are chosen and applied for compliance with quality assessment. The included articles will be chosen according to the following evaluation:

- Articles that discuss factors regarding teaching and learning English by employing AR.
- Articles that clearly articulate an approach, model, or framework.
- Articles that address the advantages and limitations of the suggested work.

Accordingly, for the articles that partially engaged the evaluation process, the search process was manifested for retrieving related and suitable information for fulfilling the quality evaluation; alternatively, the article will be excluded. Such a process on the chosen paper is significant for gaining the accuracy of the data extraction findings. The structure of a research question consists of a series of questions and the following answers: yes, no, partially, where "yes" indicates that the criterion is explicitly articulated in the text, "partially" indicates that the criterion is neither explicitly nor completely explored, and "no" indicates that the criterion is not cited. The questions employed in the article's selection process are depicted in Table 5.

**Table 5.** Research question structure.

| Question | Answer |
| --- | --- |
| Do the articles indicate significant factors regarding the effectiveness of teaching and learning English language skills by employing AR? | (Yes, No, Partially) |
| Do the articles suggest any framework, approach, model, game, or application in teaching and learning English language skills by employing using AR? | (Yes, No, Partially) |
| Do the articles contrast the advantages and disadvantages of the current works? | (Yes, No, Partially) |

*Data Analysis*

As for SLR, thematic analysis was used for analyzing the interviews. According to Braun and Clarke, thematic analysis is a technique used for analyzing qualitative data that suggests identifying patterns across a data set to pinpoint, analyze, and report repeated patterns [42]. Thematic analysis entails both a thorough review of the literature and collecting related data for various codes [43]. Its significance lies in enabling researchers to constitute themes before analysis, permitting the emergence of sub-themes throughout data

analysis [44]. The researchers relied on the themes that have been pinpointed in previous studies in developing the codes [45]. To guarantee the validity and reliability of the instrument, the interviews were carried out by one of the authors to maintain consistency throughout the study [46]. Furthermore, the study asked two researchers to express their opinions regarding the newly pinpointed themes. The truthfulness and accuracy of scientific findings are of interest to validity [47]. Four criteria determine the authenticity of the results, namely, credibility, dependability, conformability, and credibility [48]. On the other hand, reliability in qualitative research is concerned with the stability, consistency, and honesty of findings that are manifested in interviewing and analyzing the findings [46]. The researchers analyzed the interview to determine the current themes, sub-themes, and generating themes in order to ensure the reliability of the study [43]. As for SLR, the study seeks to analyze the data according to research questions developed in SLR. According to Dewey et al. [49], SLR defines, chooses, and critically evaluates research to answer clearly articulated questions [49].

## 6. Findings

### *6.1. Interviews*

The findings of the previous studies pinpointed several advantages related to the importance of AR for learning English skills, such as improving students' motivation, engagement, attitudes, and achievements. The researcher refers to interviews by using the initials of the respondents as indicated in Table 1.

#### 6.1.1. Improving Students' Reading Comprehension

All the interviewees point out that they use AR games for learning English, particularly reading skills that enrich learners' experience during reading activities, such as the Wanderscope application, which is a storytelling app that transforms everyday locations into real-time stories. The app also helps students learn to read. They ask the story's characters questions and listen to their responses. The participants found that AR plays a pivotal role in improving students' comprehension. According to Chang et al., AR promotes students' motivation toward learning English, particularly reading skills [32]. This finding was supported by one of the participants, who indicated that every school and academic institution has to use AR due to its significant role in increasing students' engagement in reading content. Additionally, SA1 underscored the importance of AR by indicating that students who are exposed to AR respond more accurately and faster as opposed to other students who are exposed to the traditional teaching methods. The majority of interviewees emphasized the positive impact of AR in increasing students reading comprehension by facilitating the process of learning English. For example, MA confirmed that using AR increases the learning permanency of the students. Moreover, another participant indicated that AR applications help the students in defining the meaning of the vocabulary items from the text, which, in turn, increases students' reading comprehension. Furthermore, one of the participants added that "AR encourages students to become more efficacious by grasping the meaning of graphics, tables, or text-related images". Students were able to define the parts that they did not understand from the text, and repeat the learning process using AR to understand what seemed difficult for them. Moreover, AR-enabled students to read without the guidance of their teachers to gain more confidence and self-learning and used their reading time wisely and efficiently since the activities were arranged in a step-by-step way. Moreover, grasping the meaning of text-related images, tables, or graphics that AR provided encouraged students to be more efficacious. HA underscored the importance of using AR applications in the classroom due to its positive impact on reducing students' anxiety levels and increasing students' satisfaction. Such a finding was confirmed by one of the participants, who indicated that students become more satisfied and less anxious when they are exposed to AR applications as opposed to traditional teaching methods, particularly when AR is tailored to improving students' reading comprehension. EG indicated that AR affects the students' cognitive load during learning that is affected

by the employed type of AR display device, information presentation, task characteristics, timeliness of the content, and user characteristics.

### 6.1.2. Promoting Students' Vocabulary Items

The majority of the interviewees indicate that they employ AR applications such as "Google Translate", which displays the meanings of the words that are needed to be translated. All the interviewees emphasized the importance of AR in promoting students' vocabulary items. According to Hsu Küçük et al. [35], AR plays a cardinal role in increasing students' vocabulary items. The findings were supported by one of the participants who claimed that AR increases students' engagement. All of which are considered good indications that AR can be helpful for language learning. Moreover, another participant added that students who are exposed to AR are able to memorize vocabulary items because AR is accessible i.e., it is not merely confined to the classroom. HP opines that AR improves students' motivation, satisfaction, and engagement, therefore, the students become more excited about learning the English language; thus, it facilitates the process of language acquisition, particularly acquiring and grasping vocabulary items. DE further suggests that AR applications paved the way for learning the language in general and vocabulary items in particular, furthermore, he believed that AR increases students' engagement and productivity. MO suggests that AR reduces students' anxiety, therefore, the students become more motivated towards learning new words. Another respondent believes that AR applications can create attractive and effective games or activities that make students more motivated and successful; he adds that AR helps learn vocabulary items, therefore, it should be integrated into the classroom to provide an effective learning process. This study seeks to know the extent of proximity in the findings of this study with the previous studies in terms of the effectiveness of AR application in learning the English language, particularly reading comprehension and vocabulary knowledge.

### 6.1.3. Increasing Students' Academic Achievements

According to Akçayır [14], AR's importance in education lies in promoting enhanced learning achievement. As one of the respondents put it forward, AR application might be effective in increasing academic achievement. To explain in more detail, another respondent elucidates that AR is beneficial in enabling the students to accomplish specific goals that are considered the core of activities in instructional environments, such as the ability of the students to answer grammar, reading, listening, and reading tasks independently. Along similar lines, EG points out that AR fosters creativity that leads to positive academic achievement. One of the participants adds that AR improves collaboration in the classroom in which the students work with others in an active learning atmosphere, which encourages students to think critically. Consequently, students' academic achievement will inevitably be increased. One of the respondents indicates that different AR games can be used in the classroom to foster students' academic achievements, such as World Brush, which enables students to paint their ideas in the real world and share them with their colleagues and other users. Another participant adds that AR increases students' motivations because it allows users to see things that are not possible in reality, which increases students' motivation.

### 6.2. SLR

The findings of the SLR lead to the effectiveness of using AR applications for learning English. Table 6 shows the classification of the outcome of previous studies that were chosen to find out some of the objectives of the study.

**Table 6.** AR assessment by teachers T (1–10) points.

| Advantage Related to the Importance of AR for Learning English Skills | T 1 | T 2 | T 3 | T 4 | T 5 | T 6 | T 7 | T 8 | T 9 | T 10 | T 11 | T 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Improving Students' Reading Comprehension | 8 | 9 | 10 | 9 | 10 | 9 | 8 | 8 | 10 | 10 | 9 | 8 |
| Promoting Students' Vocabulary Items | 9 | 8 | 9 | 10 | 8 | 9 | 9 | 9 | 8 | 10 | 9 | 7 |
| Increasing Students' Academic Achievements | 9 | 9 | 8 | 8 | 8 | 8 | 9 | 7 | 9 | 9 | 8 | 9 |

The discussion depends on SLR research questions as follows:

## 7. Learning English by Using AR Applications

The first research question is: Do the articles indicate significant factors regarding the effectiveness of learning English language skills by employing AR?

A closer inspection of the reviewed articles shows that there are a variety of factors regarding learning English by using AR applications, as indicated in Table 7 below.

**Table 7.** Outcomes of using AR applications for learning English.

| Outcomes | Articles |
|---|---|
| AR improves reading proficiency | [31,32,37] |
| AR enhances students' motivation | [32,36] |
| AR improves students' learning performance | [37–39] |

Reading proficiency is considered one of the main outcomes that prompt schools and other educational institutions toward using AR applications because it promotes students' motivation towards learning English, particularly reading skills [32]. Accordingly, AR might help students build better reading skills [31]. One of the AR applications that can be used for improving students' reading skills is Jigspace; such an application not only improves students' reading skills but also enriches their presentation [37].

Motivation is a paramount condition for learning the English language. One of the methods that can be used for increasing students' motivation in the classroom is AR tool because it is different from traditional teaching methods. AR tool is effective because it facilitates the process of learning English and improves students' motivation [36]. Likewise, it promotes students' motivation toward learning English [32].

Learning performance is highly important for learning the English language in which AR applications play a pivotal role in improving learning performance [32]. AR enhances students' concentration, improves students' confidence, enhances students' satisfaction, and improves learning performance [38]. AR has a positive impact on increasing knowledge retention, which, in turn, improves students' learning performance [39].

## 8. Existing Suggested Works

RQ2: Do the articles suggest any framework, approach, model, game, or application in teaching and learning English language skills by employing AR?

As for the finding yielded from the SLR study, the suggested work is recorded for each article. Most of the studies were concerned with learning English by using AR application rendered frameworks, games, or applications. The model, framework, and approach of AR application in the domain of learning the English language are illustrated in Table 8 below.

**Table 8.** Existing suggested works.

| Classification | Illustration |
| --- | --- |
| Problem-based gaming model using augmented reality [31]. | Using AR mobile games for reading and printed games for reading to increase learners' attitudes and engagement toward foreign language learning in which the study used narrative-driven, location-based AR games. |
| Online mobile games, mobile devices, and applications using augmented reality [36]. | Using AR mobile devices and online mobile games and applications for learning English. |
| Educational applications using augmented reality [37]. | Using education apps, such as 3DBearAR, catchy words AR, Jigspace, and Google Translate for learning English. |
| An augmented reality AR compound verb learning system for supporting students learning of compound verbs by using Maya, which is a 3D computer graphics software employed for creating visual effects and interactive 3D animations [39]. | The framework presents the meaning of both individual verbs and compound verbs by 3D animations created employing Maya according to the image schemas of the verbs. |
| Keller's ARCS model including attention, relevance, confidence, and satisfaction was adopted as a framework for the study [38]. | The model combines motivation theory and other learning-related theories for improving students' motivation toward learning. |
| AR flip card for learning English [18]. Two AR educational game approaches for learning English namely, the self-directed learning approach and task-based learning approach [35]. | Using AR flip cards to improve students' vocabulary items. Using two AR game systems for improving English vocabulary items. |

## 9. Advantages and Limitations

RQ3: Did the articles present the advantages and disadvantages of the current works?

Table 9 resents the advantages and disadvantages of the papers. The findings reveal that the current papers enhance learning English by using AR applications. For instance, the implementation of a problem-based gaming model increases students' engagement and increases students' level of cognition. On the other hand, there are some advantages in the present papers that might be refined to satisfy students' demands for achieving learning objectives. Some of the challenges are embodied in the fact that using AR might divert students' attention and disrupt their engagement with their classmates and teachers because this technology is new. AR applications need continuous development. AR applications restrict students' perceptions to a certain extent.

**Table 9.** Advantages and disadvantages of the papers.

| Classification | Advantages | Limitations |
| --- | --- | --- |
| Problem-based gaming model using augmented reality [31]. A systematic literature review was used. The method was qualitative. | The findings revealed that both the AR game group and print group exhibited similar levels of cognitive, behavioral, emotional engagement, and positive attitudes towards the importance of AR in learning English. | The learners preferred printed games because they believe that it is more beneficial than AR games. An application of location-based, narrative-driven AR games in foreign language education should be developed. |
| Augmented reality for early ages [50]. A total of 20 children from the kindergarten of Central China Normal University; the study sought to teach children cat, plane, fish, dog, and car. The study used AR mobile application. Mixed methods were used to analyze the data. | The findings revealed that AR has significant advantages in improving students' vocabulary retention. Moreover, the students' ability to memorize the words increased with age. It increased students' enthusiasm for learning. | The study suggested combining AR with traditional English teaching. |
| Online mobile games, mobile devices, and applications using augmented reality [36]. The sample contained 38 elementary students in northern Taiwan. The data were analyzed quantitatively and qualitatively. | The findings of the reviewed literature in the study showed that AR application is useful, increases students' motivation towards learning English, improves students' satisfaction and enjoyment, promotes reading comprehension, reduces students' anxiety level, and increases knowledge retention. | The students face challenges in maintaining superimposed information that can be solved by developing AR applications. Second, the distraction that might be provided by AR because such technology is new, therefore, it might divert students' attention. Third, it might disrupt students' engagement with their classmates and teachers. |

**Table 9.** *Cont.*

| Classification | Advantages | Limitations |
|---|---|---|
| Educational applications using augmented reality [37]. A sample of 40 junior high school students participated in the study; 21 in the experimental group, and 19 in the control group. The study used a mixed methods approach. | AR increases students' collaboration and engagement, improves students' creativity, promotes English language acquisition and development, and enhances students' intra and interpersonal communication. | The high cost of the AR hardware and software applications used for learning English, AR restricts students' perceptions to a certain extent, and using AR applications could affect students' eyesight and physical health in the long run. |
| An augmented reality AR compound verb learning system for supporting students learning of compound verbs by using Maya, which is a 3D computer graphics software employed for creating visual effects and interactive 3D animations [39]. An interview was conducted with 30 participants in which the data were analyzed qualitatively. | The findings show that AR promotes the learning effectiveness of students' compound verbs, and increases students' knowledge retention. | The explanations and the animations of the verb do not appear on the same screen, therefore, the application needs to be developed. |
| Ref. [51] carried out a study on using AR for teaching English to young learners. A systematic literature review was used. The data were analyzed qualitatively. | It promotes students' interactions. It increases students' motivations. | The cons of AR for young learners were manifested in the fact that AR should be tailored in a manner that attracts the students' attention and by taking into account the student's physical and psychological status. It might lead to students' isolation. The issue of practicality and usability. |
| Keller's ARCS model including attention, relevance, confidence, and satisfaction was adopted as a framework for the study [38]. The sample consisted of 21 students: 12 males and 9 females in Japan. A quasi-experimental design was used in which 10 students were assigned to the experimental group and 11 students were assigned to the control group. | The study found that AR positively affects students' satisfaction, confidence, learning effectiveness, and concentration of ESL students. | The limitation of the study lies in the necessity for continuous practice for accumulating performance in language communication skills. Moreover, educators should prepare a long time for curriculum design and system development. |
| AR flip card for learning English [18]. The study used a multimodal technology in which the data were analyzed qualitatively. | AR motivates students towards learning English vocabulary items. Moreover, it increases students' comprehension. | The study is limited to improving vocabulary items of the students by using AR flip cards. It cannot be generalized to other English languages. |
| Two AR educational game approaches for learning English namely, the self-directed learning approach and task-based learning approach [35]. A sample contained 90; 34 were in the experimental group, and (36) control students participated in the study. The data were analyzed quantitatively using a one-way MANOVA. | The findings reveal that the students employing any of the two approaches had similar and high learning effectiveness, however, the students employing the self-directed system showed higher flow experience. | Restricting which step to begin with was not necessary, but rather providing free learning steps was preferable. |

## 10. Discussion

The explanation of the results of the study as well as the conclusions that were drawn from the study are clarified in the subsections below.

This qualitative study aims at exploring AR advantages for learning English. This study showed that AR's importance for language acquisition is manifested in improving students' reading comprehension, promoting students' vocabulary items, and increasing students' achievements. The findings of the interview showed that AR improved students' engagement, academic achievement, vocabulary items, and reading comprehension. Narrowly speaking, students' reading comprehension is improved significantly by using AR applications for learning English. The findings of the interview indicate that the teachers believe that AR increases students' engagement in the classroom. A number of studies [13,24] conclude that AR would increase students' engagement with reading English. AR improves students' motivation toward learning English because its immersive and interactive qualities may motivate students to participate in learning activities and increase their enthusiasm to study. Furthermore, AR increases learning permanency [37–39]. Moreover, AR increases students' satisfaction [36,38]. Perhaps the improvements in students' learning by using AR applications increase their satisfaction. Additionally, AR reduces students' anxiety by facilitating the process of learning English and increasing students' autonomy

and confidence [34,36]. Along similar lines, AR affects the students' cognitive load during learning [34,39]. Possibly, AR applications have been revealed to positively impact mental workload and task performance.

Regarding promoting students' vocabulary items, AR improves students' vocabulary knowledge such as using "Google Translate", which is an AR application that requires the students to point at the device towards an object that displays a word and then the translation will appear; thus, it differs from traditional teaching methods. The study has done work that others had already approved and the paper's findings are in line with that (Lakshmi and Suresh, 2020). The effectiveness of AR applications in learning English is manifested in increasing students' engagement and motivation because learning by using AR applications is considered more effective and more enjoyable than the traditional teaching method. It is in keeping with a number of studies [32,36,38]. Another interesting finding is that AR increases students' satisfaction; this could be due to the fact that the students show positive attitudes towards using AR for learning new vocabulary items. It is supported by several studies [36,38]. Moreover, the findings show that AR increases knowledge retention in which the new words remain for a long time in the memory. A possible explanation for this might be that AR encourages students to find out the meaning of the words; thus, it improves students' critical thinking skills. In the final part of the analysis of the interviews, if AR reduces students' anxiety, the participants agreed that students who use AR applications are not embarrassed when making mistakes because they are dealing with an application, not a human, unlike traditional teaching methods, therefore, the students become less anxious. As the authors of [34] put forward, AR reduces students' anxiety.

In respect of increasing students' academic achievements, AR applications enable students who regularly employ such technology to take more pride in their work, increase their confidence, and develop higher levels of self-esteem, which, in turn, affect students' academic achievements. Possibly, AR applications and games enable students to suggest and share ideas with their colleagues, which improves students' creativity. It is in keeping with [37] regarding the importance of AR in developing students' creativity. AR improves students' motivation this could be due to the fact that learners see different things that are not seen in real life. Therefore, students become more motivated towards learning new matters. As a result, AR reduces students' anxiety because the more students are motivated the less anxious they become.

However, there were different opinions regarding the most important skill that can be improved by using AR applications. It emerged that educators considered reading and learning new vocabulary items as the most important skills that can be developed. In general, there was agreement among all towards AR's effectiveness in reducing students' anxiety and increasing students' motivation, engagement, and satisfaction. The study recommends conducting future research that compares the impact of AR on improving English language skills in depth.

## 11. Conclusions

The future of using AR technology for learning English language skills is promising and the features presented in AR applications are captivating. In conclusion, this paper elaborated on AR technology and how it could benefit the education sector, particularly in the learning of the English language. This paper used mixed methods. First, semi-structured interviews regarding the importance of AR in learning English with 12 teachers from different schools. A systematic literature review of the chosen papers depends on three research questions concerning learning English by using AR technology. The findings of the semi-structured interview show that concluded that augmented reality improves students' reading comprehension [32]. This study is not limited to the impact of augmented reality on improving speaking proficiency and listening comprehension. Furthermore, the findings showed that augmented reality improves students' vocabulary knowledge, such as using "Google Translate", which is an augmented reality application that requires

the students to point at the device towards an object that displays a word and then the translation will appear; thus, it differs from traditional teaching methods. It is reinforced by Lakshmi and Suresh, 2020. Moreover, it improves students' academic achievements because it enables students who regularly employ such technology to take more pride in their work, increase their confidence, and develop higher levels of self-esteem, which, in turn, affect students' academic achievements. Possibly, augmented reality applications and games enable students to suggest and share ideas with their colleagues, which improves students' creativity. In this respect, Chang et al. [37] stress the importance of augmented reality in developing students' creativity. The finding of this study is not limited to the impact of augmented reality on improving students' engagement and satisfaction.

As for the findings of SLR, it revealed that augmented reality game group and print group improve students' cognitive, behavioral, and emotional engagement, and the students have positive attitudes toward the importance of AR in learning English [31]. Moreover, AR application is useful, increases students' motivation towards learning English, improves students' satisfaction and enjoyment, promotes reading comprehension, reduces students' anxiety level, and increases knowledge retention [36]. It increases students' collaboration and engagement, improves students' creativity, promotes English language acquisition and development, enhances students' intra and interpersonal communication, promotes the learning effectiveness of students' compound verbs, and increases students' knowledge retention [37]. It promotes the learning effectiveness of students' compound verbs and increases students' knowledge retention [39]. It improves students' satisfaction, confidence, learning effectiveness, and concentration of ESL students [38]. AR motivates students towards learning English vocabulary items.

The findings of this study showed that augmented reality improves reading comprehension, academic achievement, vocabulary items, students' motivation, engagement, collaboration, and creativity. Future research may enrich a close reading of the importance of augmented reality in improving the speaking and listening skills of the students. Moreover, the results of this study suggest an increased focus on the importance of augmented reality in teaching English metaphors, idioms, and collocations. The study recommends future work to bridge the gap in the existing limitations on designing AR applications or games to enhance learning English skills. To generalize these findings, the teachers should be trained enough concerning the use of AR to be able to take advantage of it.

## Appendix A

**Table A1.** The questions of the interview.

| | |
|---|---|
| 1 | What is your information about AR applications and games? |
| 2 | Have you used AR for teaching and learning English skills? |
| 3 | How do you think AR application could improve the motivation of EFL towards learning English skills? Why? How? |
| 4 | What is the effectiveness of AR on learning and teaching skills? |
| 5 | What is the effectiveness of AR on learning and teaching skills? |
| 6 | How can AR reduce students' anxiety levels? |
| 7 | What is the impact of AR on students' cognitive load during learning? |
| 8 | What is the impact of AR on students' cognitive load during learning? |

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