Educational Augmented Reality Technology for Language Learning and Teaching: A Comprehensive Review

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Abstract

The purpose of this paper is to present a review of Augmented Reality (AR) technology as an educational tool for foreign language education. Following a short yet comprehensive literature review, the paper reviews educational AR technology in terms of learning theories, learning pedagogies, teachers, students, culture, infrastructure, and sustainability based on the framework developed by Osterweil et al. (2016) for evaluating the appropriateness of educational technology use in global development programs. The review showed that AR technology provides several benefits for language learning; however, it is not ready for total integration into language classes. The paper also provides practical suggestions for activities enriched with AR in four language skills and recommended applications. This review offers various implications for teachers, teacher educators, researchers and coursebook developers.

Keywords: Augmented reality, Educational augmented reality, AR, Augmented reality for language learning, Augmented reality for language teaching

Introduction

Language teachers employ several materials in their lessons ranging from traditional coursebooks to digital technologies such as vocabulary learning software packages and e-portfolios. With the availability of numerous digital tools, teachers now need to evaluate the digital tools more meticulously. They have a certain experience with traditional coursebooks. Moreover, traditional coursebooks are "relatively straightforward to evaluate because they tend to have a transparent structure allowing teachers to... get an overview of the organization and content" (Hubbard, 2006). However, with the ampleness of the course materials and tools, it has become a tall order to choose a digital tool for language learning and teaching. Hubbard (2006) notes that it is a very "unique challenge" to evaluate and choose a CALL software.

Before evaluating a CALL software, it is important to probe the concept of evaluation in detail. Hubbard (2006) elaborates the concept of evaluation on three bases namely, "(a) investigating a piece of CALL software to judge its appropriateness for a given language learning setting, (b) identifying ways it may be effectively implemented in that setting, and (c) assessing its degree of success and determining whether to continue use or to make adjustments in implementation for future use" (Hubbard, 2006). These three bases can be named as "selection, implementation and assessment" (Hubbard, 2006).

An evaluation for courseware or a digital tool should be situation-specific, inclusive of teaching context, learner characteristics, and learning objectives. As we are not assessing AR in a specific teaching context, this paper will be regarded as a review of AR in language learning and teaching, rather than evaluating it. It is also important to note that the studies in the related literature focus on experimental research with AR and a state-of-the-art review of papers by Parmaxi and Demetriou (2020) for language learning. However, there seems to be a lack of review regarding instructional uses of AR technology and suggestions of applications that can be utilized in foreign language education contexts. Thus, this review paper aims to fill this gap by exploring the instructional and practical use of AR technology about learning theories, learning pedagogies, teachers, students, culture, infrastructure, and sustainability then supported with four separate language skills. Hence, this current review paper is driven by the research questions of:

1. What is the current literature on language learning and teaching with augmented reality?
2. How can augmented reality technology for language learning and teaching be evaluated as an educational technology tool within the framework of evaluating the appropriateness of educational technology?

Literature Review
Augmented Reality

To review technology for its availability for language learning, we should sift through the current literature along with its comprehensive definition, working principles, related apps and concepts. With the time and demands it brings, the education systems are continually in need of reform. The generation of today was bombarded with technological advancements. Thus, adapting to the new technologies is simpler for this generation as they're already center their lives on digital technologies (Lee, 2000). Our students are born into digital life, and they are even referred to as "digital natives" (Prensky, 2001). Every digital technology or technological innovation, even though they are not designed particularly for education, has penetrated classrooms and these include blogging, instant messaging, podcasting and even virtual

environments. Among those, there comes up the emerging technology of AR, which continues to gain momentum in education (Atwood-Blaine & Huffman, 2017).

Contrary to the belief, AR is not an unknown and complex technology. Furthermore, most people have used it at unawareness; for instance, "adding virtual glasses or monkey masks on your face on Snapchat or Instagram" is an example of AR because "the reality is augmented by these filters" (Karacan, 2019). It is such a technology that nine out of every 10 brands intend to utilize AR in their campaigns (BIS Research, 2018). With the affordability of powerful mobile devices, mobile AR is considered one of the most impactful technologies in the next decade (Alakärppä et al., 2017). To clarify, AR is a new-generation technology that allows users to experience assigned video, picture, audio, or 3D objects upon scanning a picture on mobile devices (Ro et al., 2018). AR is not limited to any specific field; rather it has found itself a place even in special education (Taylor et al., 2017).

Augmented Reality in Education

Mobile AR and game-based learning were asserted to have a positive impact on English language teaching (Taşkıran, 2019). With the affordability of powerful mobile devices, educational AR is considered one of the most impactful technologies in the next decade (Alakärppä, et al., 2017). This impact is not specific to any field; however, AR is believed to become widespread and mainstream in education after 2020 (Huang et al., 2012). With the affordable prices, there has been flourishing access to powerful smartphones which enabled games such as Pokémon GO to have incited spreading interest towards AR in foreign language education (Hockly, 2019). However, empirical research on AR enhanced foreign language teaching is "still thin on the ground" (Hockly, 2019).

Augmented Reality in Foreign Language Teaching

In discussing educational AR's efficacy in education, there needs to be boundaries and specifications as the technology itself is very distinct. The field where this technology will be utilized poses great importance. It is safe to say that AR

technology is mostly used in education for science classes for covering human anatomy, the universe, chemical reactions and plant anatomy contents. However, this paper deals with AR's place in foreign language education. A very limited number of AR applications and content are available for language education. The mobile AR applications can be grouped into three depending on their purpose, place of use, and usability. This review study categorizes AR applications into three categories: image-based, creation-based and markerless AR (See Table 1). It should also be noted that some apps in these categories may have both creation-based and markerless features. However, if an app is an image-based one, it can't have a markerless AR feature because it could only work with flashcards.

Table 1: Types of AR Applications

Table 1. Types of AR Applications		
Image-based AR	**Creation-based**	**Markerless AR**
Quiver	Zapworks	MetaVerse
Space 4D+	MetaVerse	CoSpaces Edu
Animal 4D+	CoSpaces Edu	ARZoo
Dinosaur 4D+	Arloopa	DevAR
DEVAR	PlugXR	SketchFab
AR ATOM	SketchFab	Figment AR
Vücudumuz 4D	UniteAR	Arize
Dino 4D	HPReveal	Dino4D
4D Flashcards	Blippar	HPReveal
SolarSystem AR+	Augment	Augment
Octaland 4D+	ARize	Assemblr Edu
	Assemblr Edu	

Image-based AR Applications: There are applications that work exclusively with sets of flashcards that can be bought at the physical stores or through online shopping sites to be delivered. Every single set of flashcards needs its application to be downloaded; however, a single app can run a few sets of flashcards only if these flashcards belong to the same company. These flashcard sets are most of the time not specifically designed for language education; however, there are numerous AR-supported flashcard products that generally present objects, animals, and vehicles as the content of vocabulary. These sets of flashcards can be used with teachers' purposeful planning.

Markerless AR Applications: The second categorization of AR applications is markerless AR. There are ready-to-use applications available on the market that fit this category and can be listed as, Elements 4D, DevAR, AR Real Animals, ARZoo, Catchy Words AR, CoSpaces Edu, Figment AR, and Metaverse. In these applications, one can find ready materials for their lessons; however, it should be noted that these ready-made applications do not always fit teachers' learning objectives, and they are not always customizable to teachers' needs. Therefore, the ready creations available in such applications will need teachers' effective instructional use.

Creation-based AR Applications: Upon these two types of AR applications, there is another type of AR application that lets users create their own customizable AR experiences. Through such applications, users can connect a picture to a video, music, 3D object or even a 360 video of their choice. The rationale behind choosing AR as an educational tool is its capacity to integrate context-specific multimedia components and proved benefits for students' language and 21st-century skills development (Papanastasiou et al., 2019). In that case, teachers can make use of these applications in which they can freely create their own contextual AR experiences. Serving that purpose, there are dozens of mobile applications on the Apple Store and Google Play Market. These mobile applications can be listed as; Blippar, HPReveal, Augment, PlugXR, Zapworks, Layar, Arloopa, Quiver, Metaverse, CoSpaces Edu, UniteAR, and ARize as the most stable ones.

Nevertheless, we live in the 21st century, during which the world is overflowed by information (Lopez-Claros et al., 2020) and every single application or digital technology ceases to exist at some point. Thus, the listed mobile AR applications in the current paper might not even be available for use by the time you scroll down to read this page. At this point, instead of learning about specific applications, it is more reasonable to grasp the working principle, search for pertinent applications and critically assess them by your teaching context as the 21st century requires. The working principle behind AR is very simple. It can be thought to build a bridge between a photo (to be scanned) and a video/ 360°Video/ audio/3D Object. A picture, also called marker, is

connected to a multimedia component such as video, audio, 360° video, or 3D object. Scanning the marker through the mobile phone's camera will pop out the attached video or 3D object in real time and within that real environment.

There is another application that does not fit into any category called Mondly AR. It is an intelligent tutoring system that allows a tutor in 3D objects to show up and tell you the translations of the words. It asks you to repeat the predetermined sentences and the voice recognition system assesses them. The application gives you a set of instructions to act on such as "Repeat after me, Let's practice conversations," etc. However, this application should be reviewed with care because it is highly commercialized, and its content is very limited.

It is important to note that the categorization given above was for the types of AR apps projected by the researcher of the current paper. These categorizations of AR apps should not be mistaken with the types of AR technology which are Marker-based AR, Markerless AR, Location-based AR, Superimposition AR, Projection-based AR, and Outlining AR.

Affordances of Augmented Reality

With the penetration of AR into education, numerous studies have been conducted to see its impact, affordances and disadvantages. Horizon Report, an annually published report covering notable trends and emerging technologies in education, highlights that VR, AR, XR, and MR technologies are now part of education (Brown et al., 2020). AR has been countlessly studied in the research studies and proved to have several affordances in education and language learning ranging from motivation (Taşkıran, 2019), academic success (Kırıkkaya & Başgül, 2019; Azi & Gündüz, 2020), retention (Lam et al., 2020), enjoyment (Arino et al., 2014) to collaboration (Bressler et al., 2018).

Learning Environment: AR has the advantage of bringing authentic and real-life learning situations to classroom environments resulting in an opportunity to engage in meaningful communication in the target language (Parmaxi & Demetriou, 2020). AR provides an entertaining learning environment for students while practicing the content (Chiang et al., 2014). Children prefer this environment to a real

environment (Juan et al., 2010). Also, a study found a strong relationship between the students' perceptions of classroom environment and motivation towards language learning (Chen et al., 2020).

Motivation: Learner motivation is one of the most mentioned outcomes of AR in the literature. Increased motivation is provided in several ways, namely, AR-enhanced books, AR-based instruction, and content presentation with AR. To begin with, first-year primary school students perceived AR as a motivational tool upon experiencing an AR-enhanced pop-up book (Mahadzir, 2013). The positive motivational effect was not limited to primary school students. Middle-school students were found to have a higher motivation upon experimenting AR (Di Serio et al., 2013). Similarly, an experimental study exploring two types of classroom instruction revealed increased motivation in high school students (Mumtaz et al., 2017).

Multimedia: AR technology allows for different multimedia modes such as text, picture, video, audio, and 3D object (Cabero & Barroso, 2016). Such multimedia components are said to facilitate language learning by reducing cognitive load and anxiety (Hwang & Huang, 2010). AR provides rich media embedded in a real-world environment in a contextual and timely manner, reducing the cognitive load by providing students with "perfectly situated scaffolding" (Bower et al., 2013). On the other hand, a study found no significant difference in results between printed teaching material (a type of media) and AR employed (Miyosawa et al., 2012).

Content Retention: It can be safely said that motivation is not enough for digital technology to be employed in the lessons. AR technology was also helpful in the retention of information, content understanding, and knowledge acquisition. Several studies in the related field put forward the profound impact of AR on content understanding (Santos et al., 2016; Solak & Çakır, 2015; Doğan, 2016). In addition to that, AR technology was observed to increase content retention by building a bridge between theory and practice that is provided with its feature of integrating virtual objects onto real-world (Ibáñez et al., 2014; Sayımer & Küçüksaraç, 2015). This is supported with another batch of studies which argued AR's long-term content retention affordance

when compared to other multimedia options and/or traditional classroom (Huang et al., 2019).

Interaction: Increased interaction is another affordance of AR technology in education. The interaction between students, teachers, and the materials paves the way for "encouraging meaningful language practice" (Parmaxi & Demetriou, 2020). Sanna & Manuri (2016) emphasized that educational AR applications improve teacher-student and student-student interactions. This was supported by another study that found improved peer interaction and communication among fourth-grade students (Chiang et al., 2014). Interaction with peers and knowledgeable others is of paramount importance as proposed by sociocultural theory (Vygotsky, 1980). Also, AR-initiated student-content interaction improved the teaching and learning process leading to better learning performance (Joo-Nagata et al., 2017; Hwang et al., 2016. In an experimental study, preschool students learning English alphabet with AR apps were also found to have increased interaction with the content compared to the control group (Safar et al., 2016). This interaction has also resulted in higher test scores.

Learning outcomes: In addition to motivation and interaction, academic success finds itself a place in the related literature. Akçayır & Akçayır (2017) emphasized in their meta-review that learner achievement was one of the most frequently mentioned educational affordances of AR. In an experimental study, an AR game was employed to teach animal vocabulary for students learning English as a foreign language. Students using AR game had a "superior English learning progress" than the control group using traditional methods (Barreira et al., 2012). Interestingly, a study revealed that academically good students did not show a sign of improvement but students with lower academic success showed a greater improvement in AR-supported lessons (Freitas & Campos, 2008). In Freitas & Campos' (2008) study conducted with 2nd grade primary school students, SMART AR system, an educational system employing AR for teaching concepts, had notable impact on the whole class collaboration. All students actively participating.

Visualization: AR's multimedia feature has been mentioned in the previous sections. It has been become possible to visualize educational content for students (Ibáñez et al., 2014). Many studies posit that AR helps students visualize complex relationships in the lesson (Wu et al., 2013). Besides, Clark and Dünser (2012) utilized AR to visualize paper-based colouring book with AR elements, which was also found to promote their conceptual understanding of the content.

Language Skills: AR technology was also employed to its impact on language skills. For instance, a research study designed an AR supported ubiquitous learning environment called HELLO and observed increased listening and speaking skill in students (Liu, 2009). Writing skill was also experimentally researched about AR and the results showed that students employing AR in writing had better results in content control, article structure and wording (Wang, 2017). A very detailed research study also found AR-enhanced writing instruction's contribution to "long-term memory, motivation, and self-regulation of cognitive processes in writing" (Lin et al., 2020).

AR technology use in education is not limited to speaking, listening, and writing. A research study came up with an application called "Letters Alive" that teaches primary school students to read through vocabulary cards enriched with relevant sentences and 3D animations (Johnson et al., 2012). Similarly, a research study aimed to teach preschool students and students using multimedia-rich AR applications had better pre-literacy skills (Majid et al., 2018).

Vocabulary Development: In addition to general educational benefits and language skills improvement, AR's impact on vocabulary learning has been extensively researched and well-documented in the literature (Hwang et al., 2016; Solak & Çakır, 2015; Ibrahim et al., 2018). AR is mentioned as a powerful tool for "increasing language learners' vocabulary size" owing to its multimedia presentation (Vedadi et al., 2018). In experimental studies, groups of adult learners using AR for vocabulary learning were found to show greater academic performance and better retention of words (Çakır et al., 2016; Hwang et al., 2016; Santos et al., 2016). Likewise, children show a very high acceptance of AR technology for vocabulary learning (Juan et al., 2010). This acceptance reflects an increased level of vocabulary learning and positive

attitudes (Barreira et al., 2012; Hsieh & Lin, 2010). We have covered the related literature and presented many AR affordances; however, AR "should not be seen as a panacea to solve all issues in English as a Second Language (ESL) learning" (Rafiq & Hashim, 2018). Furthermore, the AR and AR-based language activities should be carefully reviewed for prospective adoption.

Methodology

The current review study evaluates the AR technology for language learning and teaching within a framework for evaluating the appropriateness of an educational technology tool.

Search Strategy: The works in literature selected from high-quality journals. Not all studies related to language learning and teaching because the literature is relatively thin on the ground when it comes to AR-enhanced language learning and teaching.

Data Analysis

The evaluation of this specific educational technology conducted by reviewing the related literature and current applications on market with expertise of researcher on AR technology. Employed framework was "Evaluating Appropriateness of Educational Technology Use in Global Development Programs" (Osterweil et al., 2016).

Findings
Review of Educational Augmented Reality

In the previous section; AR, its' types and affordances were put forward. This section presents an evaluation of educational AR technology for language education in terms of learning, pedagogy, teachers, students, culture, infrastructure and sustainability under the framework of "Evaluating Appropriateness of Educational Technology Use in Global Development Programs" (Osterweil et al., 2016). It later concludes with practical advice for language learning activities followed by a discussion and conclusion part.

Teacher Perspective

As teachers are the ones who are going to initiative AR in their classes, their comfort, competence, openness to change, role and classroom management issues should be considered. It is safe to say that digitally immigrant teachers will have a hard time using this technology and that's not because it is complicated; rather, it poses unexpected errors and problems which might require prior experience with various technology tools and platforms. Teachers' competence in using this technology is crucial and this competence can be provided with professional development, which needs to be related to teachers' teaching context. As AR is considered supplementary technology for a limited number of activities, semester-long and jam-packed professional development sessions are not on the table. In terms of openness to change, most teachers at the beginning suppose that AR technology is very complicated to understand and implement; however, they have a change of heart after having practical sessions and they feel empowered. During the integration of this technology in the activities, classroom management becomes an issue that is up to the teacher to handle. With students having lots of fun, the class might go out of control. However, if teachers intelligently integrate this technology into their activities, it becomes a powerful tool. In the curricula, there are learning goals to be met and educational tools should help working towards that. Educational AR applications do not easily provide this; however, they help students understand the concepts and content through visualization (Sanabria & Arámburo-Lizárraga, 2017). Educational AR apps do not assess student learning; thus, AR does not seem to go further beyond the multimedia support for now. The cultural relevance of the technology is also one of the things to be considered. AR can be very culturally relevant and appropriate if the teacher chooses suitable content and controls the process.

Student Perspective

Students, on the other hand, are one of the two main considerations in evaluating an educational technology, the other being the teachers. Their comfort with the technology, access to the technology, and openness to change should be carefully reviewed. Students of this age grow up with various technological devices full of unlimited applications (Prensky, 2001). In that sense, there is a strong possibility that they are comfortable with the AR technology (Wang et al., 2017). Yet, they need to be supported by their teachers at first. It is

quite possible after that students will come up with unthought-of uses of that technology as the author himself observed it in his sessions on AR. However, accessibility is a problem since AR technology requires smartphones and not every child has access to such devices.

On the other hand, many governments in recent years have decided to equip all students with tablets and the classes with interactive white boards. In some schools, tablet-based instruction is at the center, which makes the AR technology more accessible. Besides, a concept that is recently on the rise, BYOD (Bring Your Device) allows students to bring their own devices such as tablets, smartphones, or laptops to school. Through BYOD, it becomes more accessible to implement AR technology. In terms of openness to change, it is safe to say that students are willing to use such technologies in and out of the class (Wang et al., 2017).

Learning theories

Nearly half of them (46%) studies about educational AR do not have a theoretical base. The most referred theoretical perspectives are the sociocultural theory (9%), situated (5%), experimental (5%) and constructivist (5%) learning theory (Parmaxi & Demetriou, 2020). AR technology has strong ties to situated learning theory because "it positions the learner within a real-world physical, and social context while guiding, scaffolding, and facilitating participatory, and metacognitive learning processes such as authentic inquiry, active observation, peer coaching, reciprocal teaching, and legitimate peripheral participation with multiple modes of representation" (Dunleavy, 2014). AR also embraces constructivism theory as augmented environment is student-centered environment nourished with constructing new information upon their existing knowledge (Delello et al., 2015).

Most educational AR applications act as multimedia providers meaning that they either transform the static image on the page to a video/audio/3D object or place 3D objects on your visual angle. In that sense, educational AR applications can be said to employ cognitive theory of multimedia learning, which argues that learning with associations to pictures, audio and video provides deeper learning when compared to learning from static texts only (Mayer, 2005). In concordance, the researchers working in this field applied multimedia learning theory as their framework for educational AR application development (Santos et al., 2016).

The learning theory to be embraced depends on the kind of instructional strategy to be used. Upon reviewing the related literature, Fan et al. (2020) groups these AR-based instructional strategies into three, namely, "instruction through presentation (i.e., teacher-centered informal instruction), instruction through discovery (i.e., learner-centered comprehensive instruction), and collaborative learning (i.e., learner-centered group studies)".

The instruction through presentation strategy refers to presenting the lesson content through AR by teacher-led instruction with advanced organizers followed by student experimentation under the teacher's guidance. This type of instructional strategy builds on Meaningful Learning Theory (Ausubel, 1977) as it perceives learning as a progressive endeavor accompanied by engagement of the students in a meaningful learning activity.

The instruction through discovery strategy, on the other hand, refers to the construction of knowledge upon previous experiences by discovering for themselves. Such strategy is accompanied by advanced organizers and gradual release of responsibility. This strategy reflects in classrooms by teachers leading the instruction and employing AR to present the content followed by students' experiencing the platform to practice extant information and search for new knowledge (Solak & Çakır, 2015).

Collaborative learning strategy makes use of small group instructions with students working in groups for problem-solving. In the studies, AR-based collaborative learning strategies were implemented in which learners took part in various activities enriched with AR.

Learning Pedagogies

Some MALL and CALL technologies can be stand-alone languages learning initiatives such as Busuu, Duolingo and Rosetta Stone. Such applications direct you in learning the new language, and they provide numerous activities to practice and produce the language. However, this individualized learning is not the case with educational AR applications as

they require teacher's competence in task design. AR cannot be used as a stand-alone learning tool; however, it can provide extra support for the content. Educational AR applications are generally suitable for task-based learning, project-based learning and game-based learning. These learning pedagogies require a sound preparation of tasks that can be enriched with multimedia technologies.

Infrastructure and Sustainability

In evaluating an educational technology tool, it is a prerequisite to taking equipment, storage, maintenance, electricity, and internet access into account. Internet infrastructure of the school is also a factor in the employment of AR technology as it will retrieve high amounts of data from the internet in real-time (Oliveira & Martins, 2011). For this technology to be effectively implemented in the classes, smartphones and tablets need to be allowed and a good understanding of these tools by both teachers and learners is a must. In a world where 21st century skills are desired, this requirement for schools is not a considerable burden. Most of the schools have Wi-Fi connections available and the data needed for AR experience will not cause a problem. On top of all that, a technological tool or a concept should be sustainable or in other words, economical in all senses. At this point, the new technology to be implemented should be thought of with its cost, funding, technology return on investment, tool maintenance and repair issues in mind. AR technology is free to anyone with a smartphone; thus, making it less of a concern.

Community/Social/Political

In evaluating an educational tool, it is also crucial to consider community, social and political issues (Osterweil et al., 2016). In implementing AR, teachers might need external technical help and administrative approval. Concerns and rejections toward an advanced technology might rise among the community. There is also the risk of commercialization of the AR by private educational institutions. Moreover, AR technology is rather thin on the community, social and political levels.

Language Skills & AR-Enhanced EFL Activities

After reviewing the relevant literature, learning theories, pedagogies, teachers, students, culture, infrastructure and sustainability of AR technology, the potential language learning activities will be discussed in this section. As stated before, AR is a powerful tool for multimedia representation. Thus, any static image can be revived using AR. Since the main focus of this paper is language education, the proposed activities will deal with language skills. As stated before, AR technology cannot be relied upon as the only source of language learning instruction. However, certain AR applications can be used as a supplementary and extracurricular activities.

To make students familiarize themselves with the AR technology and improve their speaking skills, a very well known social media platform Instagram with its filters, can come into play. Students can create various videos of themselves speaking using different masks and filters. In improving the speaking skill, Mondly AR can be implemented as an extracurricular activity for beginner learners as this application provides beginner to pre-intermediate level language content. Coursebooks are generally full of activities that propose preparing posters; thus, students can be given a project in which they need to prepare the classic poster and add augmented videos of themselves introducing the poster. On the other hand, Quiver can be used to revive your drawing and preschool and primary school students can be instructed to talk about their creations.

It is not advised to separate the listening and speaking skills. Anything that can be used for speaking is also a product of listening. Not to derail from our topic, for listening skill, Wonderscope AR app is an iOS app for kids that uses AR to transform ordinary spaces into extraordinary stories can used.

Reading skill improvement with AR technology was also mentioned in the related literature. In an experimental study conducted with 5th-grade students, the students in the AR group showed higher reading comprehension and learning permanency along with increased satisfaction and positive attitudes stemming from AR-based reading activities (Bursalı & Yılmaz, 2019). Another study explored how six to seven years old children reading AR books experience and interact with it (Hornecker & Dünser, 2007). A very famous story called The Little Prince, for instance, has now an AR book version through which students can read the story enriched

with animations of the characters. It sometimes tells some parts of the story, which can contribute to students' understanding of the content and their listening comprehension. Another application that can be used for reading is Metaverse which lets users create their own AR story and scavenger hunt activities using this application is very suitable.

Contrary to popular belief, AR can be used for writing (Göktaş, 2016; Wang et al., 2017). Students can compose a creative story after drawing their animals on the paper and reviving them through Quiver. It is no doubt that AR triggers imagination through its multimedia feature and this leads to a better description of scenes by students. For more advanced levels, there are AR applications that show the conjunctions to used in a variety of essay types.

Vocabulary learning is one of the most suitable components of a language to master with AR with various activities such as "word spelling games, word knowledge activities and location-based word activities" (Fan et al., 2020). Learning with AR-based flashcards has been subject to research studies that concluded better long-term vocabulary retention in students employing AR-based flashcards to practice vocabulary (Beder, 2012).

In addition to these skill-based EFL activity ideas, Bonner and Reinders (2018) designed and proposed several AR-enhanced EFL activities from "giving and following directions" to "information gap" activities.

Discussion & Conclusion

In short, AR technology in educational contexts has constantly been reported to contribute to several factors. There are numerous AR apps to take advantage of and implement in the language courses. As this technology was not specifically developed for educational and language learning purposes, its integration into the activities and tasks requires a well-thought teacher touch. When carefully reviewed in terms of learning theories, learning pedagogies, teachers, students, culture, infrastructure, and sustainability aspects, the educational AR does not strike a pose as the greatest choice for language learning due to a) not being specifically designed for education, b) does not completely fit with a certain learning theory, c); however, this technology has a great potential to take over language learning field

shortly with the upcoming advancements in the virtual environments, machine learning and artificial intelligence. In the future, AR along with VR, MR, XR is likely to take their places in all parts of education. Furthermore, both students and teachers had an intense interaction with the technology in the last year due to the Covid-19 pandemic. This familiarity can be a positive factor in the employment of AR when schools open doors to education again.

Availability of Data and Material

The data that support the findings of this study are openly available on various publishing websites with their reference numbers. The authors confirm that the data supporting the findings of this study are available within the article's references section as it is a review study.

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