# Augmented Reality to the Rescue of Language Learners

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## Abstract

Technology permeates all aspects of our lives, including the field of education. As educators in the field of language learning, we understand the importance of technology and the benefits it brings to classrooms. This inspired us to explore the use of an ever-evolving form of technology, augmented reality (AR), to help English learners (ELs). The purpose of this conceptual paper is to shed light on the potential value of using AR in language classrooms and provide an example of how teachers might adapt textbooks for ELs. The model we provide is a project, called "Reader Buddy," in which we augment vocabulary, integrate skills, and extend learning beyond the boundaries of classrooms. A work in progress, Reader Buddy provides an example of how AR-based textbook supplements have potential to improve the quality of language teaching and learning. These AR supplements come to the rescue of ELs who face language-related struggles in their classes.

**Keywords**: augmented reality, English learners, language learners, textbook supplements

Augmented reality (AR) has been widely used in many fields, including education (e.g., Akçayır, Akçayır, Pektaş, & Ocak, 2016; Bajura, Fuchs, & Ohbuchi, 1992; Mathew & Alidmat, 2013). However, it has not been widely used for language learning. Azuma et al. (2001) define AR as a system that "supplements the real world with virtual (computer-generated) objects that appear to coexist in the same space as the real world" (p. 34). They posit that AR merges virtual and real-world objects to create an interactive experience that occurs in real time.

This conceptual paper explores how AR can be used in school classrooms. It describes how language educators, the authors of this paper, language educators who have worked with language learners from different linguistic and cultural backgrounds, perceive the importance of infusing AR into classrooms and the benefits it can afford English learners (ELs). This paper begins with a definition of AR and then reviews literature supporting the usage of AR in different fields. Next, it provides a summary of the theoretical frameworks supporting the usage of AR. It also demonstrates the authors' vision of how AR can be incorporated in the content-area classrooms (e.g., science) to enhance language learning. Finally, it offers an example of how educators might prepare AR supplements to use along with the teaching and learning materials available to them at their schools.

## Literature Review

Augmented reality, as its name indicates, involves augmenting reality (Bronack, 2011). AR integrates a virtual world and the real world through overlaying of pictures, audio, and video information. In education, proponents argue AR increases the effectiveness of teaching by making learning a more interesting experience, and, in turn, enhancing students' learning and

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Due to increased awareness about the positive role AR can play in education, it has been used in K–12 education (Chiang, Yang, & Hwang, 2014b) as well as university settings (Ferrer-Torregrosa, Torralba, Jimenez, García, & Barcia, 2015). Across many disciplines and contexts, research demonstrates the success of using AR to enhance learning. In medicine, AR has enhanced medical visualization by providing 3D ultrasound, which involves a combination of video and real-world images (Bajura et al., 1992). Similarly, in physics, AR has been seen to promote engagement and positive attitudes of university students regarding course content matter (Akçayır et al., 2016).

The literature shows that AR can promote positive learner outcomes. For instance, Lu and Liu (2015) reported that AR activities help develop learner confidence. In addition, Kamarainen et al. (2013) mentioned that incorporating AR in education enabled learners to reach a better understanding of subject matter. Furthermore, Chiang, Yang, and Hwang (2014a) pointed out that AR increased motivation, which is a topic that has received much interest in the language learning field.

While educators in any discipline may face a variety of obstacles in their teaching, language differences can exacerbate those challenges. To overcome these, they might employ visual aids to improve ELs' comprehension and to promote a more relaxed learning experience (Shabiralyani, Hasan, Hamad, & Iqbal, 2015). In a study on the effectiveness of audio-visual aids, Mathew and Alidmat (2013) found that they were useful not only for the language learners but for the teachers as well. This is not surprising since we, as language educators, know firsthand that a picture is worth a thousand words and that showing a language learner a picture of a rhinoceros, for example, helps avoid lengthy descriptions, saves time, and ensures better comprehension. Invoking the learners' vision results in lowering their cognitive load thereby leading to better opportunities for memorization (Fujimoto, Yamamoto, Kato, & Miyazaki, 2012). Research by Hsiao, Chen, and Huang (2012) reports that AR also provides opportunities to learn by doing, which can make learning more interactive and less passive.

Being in a school classroom may not adequately immerse learners in, or provide sufficient exposure to, the target language and its culture. Research indicates that immersion leads to benefits on several levels: cognitive, academic, and linguistic (Fortune, 2012). However, direct and adequate contact with the target language is not always possible, especially in countries where English is hardly spoken. AR comes to the rescue by creating an immersion-like experience. Overlaying virtual objects in real life, AR provides a sense of being in an authentic environment (Yang & Liao, 2014). Among the many other benefits of AR is its ability to increase ELs' interactivity with information (Ibáñez, Di Serio, Villarán, & Kloos, 2014), which is particularly important in language education where communication and interaction are at the heart of learning. In addition, AR allows for the presentation of visual information (Santos et al., 2016), which is beneficial because it provides learners with multimodal representations of course material, thus alleviating some of the stress of learning and allowing for heightened understanding (Mayer, 2014). In their attempt to learn a new language, ELs strive to memorize vocabulary, which is made easier with AR since research indicates that it promotes language acquisition by decreasing cognitive processing demands (Fujimoto, Yamamoto, Taketomi, Miyazaki, & Kato, 2013).

Another central issue in language learning is authenticity (Chapelle, 1997). Research shows that AR can help bridge the gap between decontextualized academic language and real-world authentic language. One example is a study by Reinders and Lakarnchua (2014), in which they demonstrate how AR can enhance learning through the facilitation of real world, authentic activities. In their study, students designed an AR campus tour to help visitors learn more about the faculty of engineering. This activity is an example of how AR can bridge the gap between textbook language and authentic language used in the real world as it engages users in authentic learning. In these types of activities, learners use language to communicate and discover information through the use of exploration and discussion.

AR not only addresses the gap between textbook language and real-world language, it also addresses the intercultural competence necessary for language learners to communicate within the surrounding context and community (Byram, 1997; Kramsch, 2009). A good example is Holden and Sykes' (2011) Mentira project, in which they carefully considered place, culture, and context to help students learn Spanish in a neighborhood in the United States. Study participants expressed their satisfaction with this type of learning.

Our brief review of the literature supports using AR to enhance language learning. Below we discuss two theories that explain why AR might be particularly effective in language learning classrooms.

# Theoretical Framework

## *Multiliteracies*

Multiliteracies. A theoretical framework that supports the use of AR in education is Multiliteracies (Cope & Kalantzis, 2009; New London Group, 1996). The New London Group (1996), who developed the notion of multiliteracies, stressed the need to address issues related to social and economic inequality in students' academic, professional, public and private lives. One of the foci of their recommended approaches is promoting a multimodal approach to literacy education that recognizes that current communication is no longer primarily monomodal written language, but instead involves multiple modalities in digital environments. Another focus of their recommendations is the need to recognize and promote linguistic and cultural differences among learners. This involves preparing learners to appreciate and value differences and to think critically so that they engage effectively in, and benefit from, discourses that are multicultural and multilingual. One of the components of the multiliteracies pedagogy the New London Group (1996) advocated was situated practice, which ties in with the theoretical framework of situated learning in that both support the use of contextualized and function-oriented learning activities. The multimodal affordances of AR supplements can help create the context that deepen ELs' understanding of new language and subject matter.

## *Situated Learning*

Situated Learning is another theory that supports the use of AR in language classes. Situated learning theory postulates that learners interact together within a certain context and that their interactions determine the quality of learning (Brown, Collins, & Duguid, 1989; Herrington & Oliver, 2000; Lave & Wenger, 1991). The more learners interact with one another and practice different tasks in groups, the more they affect each other's level of learning. Another key notion in situated learning is that learning experiences should be purposeful and that learning experiences are tied to the contexts in which they occur (Herrington & Oliver, 2000). The idea is for students to gain procedural knowledge that they can apply in purposeful, real world activities. Applied in language learning contexts, situated learning-based activities would involve real world, purposeful communicative tasks in authentic contexts. The multimedia affordances of AR-

infused learning materials (e.g., video, audio, text, images) would enable teachers to provide ELs with learning experiences that are similar to real life.

Both the empirical literature reviewed in this paper and the language learning theories we discussed provide support for the use of AR in language learning classes. Research indicates that the use of AR can facilitate learning across grade levels and the disciplines. Furthermore, multiple studies describe the potential affordances of AR in promoting the acquisition of second language (L2) cultural and linguistic competences. In the following section, we outline how we developed and began to implement an AR textbook prototype in our language learning classes and the different AR-infused activities we designed.

# Our Approach to Using AR in the Language Classroom

The following is a description of the process we employed to develop and use the prototype of our proposed AR-based text supplement, Reader Buddy. This can serve as a model for other teachers to begin thinking about how they might infuse AR into their own classrooms, regardless of the subject they teach.

## *Reader Buddy Description*

The primary focus of Reader Buddy is ELs who need help reading grade-level science textbooks. These learners might be unfamiliar with concepts or English terms they encounter in their textbooks and thus face difficulty understanding their contents. Using Reader Buddy, we strove to make school textbooks more comprehensible by overlapping the real world with virtual objects in real time. We did this using several modalities such as pictures, audio, and videos to provide definitions, examples, and context.

Reader Buddy's provision of definitions, examples, and context in multiple modalities means it can help learners deepen their understandings of new language and subject matter content by affording them access to these new meanings through multiple semiotic systems, each with its own "distinct possibilities and limitations." (Jewitt, Bezemer, & O'Halloran, 2016, p. 16). 3). Moreover, it brings forth a new kind of intelligence, which we may refer to as 'digital intelligence' (Mithas & McFarlan, 2017). Reader Buddy AR supplements are activated by triggers or Quick Response (QR) codes, which teachers can embed in currently existing print textbooks. At the beginning of every chapter, AR glossaries employing pictures, videos, and multilingual translations introduce the pronunciations and meanings of new words, thus helping ELs to work at the same pace as their classmates. In addition, Reader Buddy videos can include and make use of new and difficult vocabulary to help contextualize the information and act as a steppingstone to facilitate the integration of various skills.

While several publishing companies offer online supplemental material, to our knowledge, none of them provide AR-infused textbooks. Reader Buddy addresses this gap through the enhancement of contextualization in the form of static pictures, audio, and videos. It can offer first language (L1) support, which in the case of our prototype is the Arabic language. To develop Reader Buddy, we obtained access to a science book for fourth graders (*National Geographic: Big Ideas Book*) and chose a section of text to use with ELs. To identify vocabulary that might be challenging for fourth-grade ELs, we field tested our prototype materials with an EL student by asking her to indicate which words she found difficult to pronounce and understand. Examples of these include *snuggling, belfry,* and *gurney*.

To help this EL, we prepared AR-infused teaching materials (flashcards with QR codes and AR triggers) that could turn her classroom and school into augmented learning environments. The EL installed QR code reader app on her iPad, so when she pointed her iPad at the AR-embedded cards, she saw a written version of the word and heard its pronunciation and its L1 translation. To

this end, the AR-infused audio flashcards provided her with background knowledge, helped her learn how to pronounce new words, and offered her their meanings in her L1 (See Figure 1). They aided her comprehension of challenging vocabulary and the reading passage as a whole. Witnessing the benefits of AR-infused materials prompted us to create a systematic plan for the development of comprehensive AR supplemental materials that we share in the following sections.


*Figure 1*. Example of a vocabulary card with a picture and QR code. This vocabulary card includes Arabic language support and it triggers an AR explaining one vocabulary item (*bats*) in both English and Arabic.

## *Reader Buddy: AR-Infused Activities*

### Pre-Reading Activities

The following activities set the tone and activate background knowledge for reading.

**Videos.** Through instructor-created AR multimedia, ELs are introduced to the title of the reading and learn about its contents. Afterwards, students are directed to work in groups to discuss what they know or have learned about the topic.

**Character quotes.** In this activity, ELs are provided with pictures of different characters. When they point their devices at them, they hear narration that extends their insight. After listening to different quotes, groups of ELs discuss what they think the text is about and what the people's opinions are.

**List-group-label.** This activity deepens ELs' understanding of new vocabulary. After an introduction to the new terms, groups of ELs brainstorm synonyms related to the topic. Afterwards, they categorize the vocabulary into groups according to relationships among the words and videotape themselves reading the lists. Finally, the teacher can attach a trigger to the list so that when other students point their device at it, their multimedia creation comes to life.

### During Reading Activities

The following activities allow students to construct meaning while reading.

**Annotated glossary.** Every reading passage includes an annotated glossary of challenging words in alphabetical order. During reading, ELs point their devices at any word, hear its pronunciation, and receive an L1 translation. They are also provided with an example of the word in context.

**Video.** For further reading strategy support and scaffolding, teachers present ELs with a brief video that provides extra assistance to help them find text-related answers. For example, if a question requires ELs to identify the main idea of a paragraph, teachers explain how to locate it in the text. With this support, ELs can avoid the embarrassment of constantly requesting classmates' help. This also acts as a time-saving device for teachers.

### Post-Reading Activities

The following activities can promote the consolidation and application of new knowledge.

**Video reflection.** At the end of the lesson, ELs can record themselves briefly explaining what they learned from the lesson as well as their impression of the entire learning experience. This represents an opportunity for them to voice their opinions on what they discussed and learned in their lesson.

**Creating a poster.** In this activity, students draw pictures of different people or events related to the story (which can serve as AR triggers) and create videos in which they reflect on the entire text or talk about it from their own points of view. When ELs point their mobile devices at them, they become activated.

Finally, teachers can introduce easy, fun, and motivational homework that aids students in relating what they are learning to themselves, engages parents in their children's learning, and opens doors for discovering, bringing in new ideas, and connecting to various cultures (Enright & McCloskey, 1988).

## Contribution to L2 Pedagogy

In the near future, we anticipate that AR will increasingly become an important aspect of education across the disciplines. Considering that AR can provide ELs with access to the contents of academic texts, we expect that its application will grow because the number of ELs in mainstream classrooms is steadily increasing (National Center for Education Statistics, n.d.). Although we developed our Reader Buddy model for fourth-grade science classes, supplements such as this would also serve as a valuable resource for students studying independently (e.g., home schooled students) or for other contexts, such as English as a Second/Foreign Language schools. ELs will no longer need to spend hours leafing through dictionaries trying to find difficult words. In addition, Reader Buddy can go further than providing the meanings of words by explaining difficult concepts and ideas.

## Conclusion

Our example of a literacy supplement includes AR activities that scaffold reading comprehension for an EL by offering multimedia support in English and Arabic. We only had the opportunity to use a couple of those activities with our EL, but the ones we used made us aware of how AR-infused activities can support ELs and make language learning an easier and more enjoyable experience. We plan to extensively use similar activities in our future classrooms to better determine how they support ELs and how we can best apply them. Teachers can copy and expand upon our proposed supplement. We recommend that teachers try it with their students' L1. Teachers can create trigger pictures, cards, or posters that students can use to learn about different topics and experience new worlds of knowledge. Reader Buddy has the potential to make a rich contribution to language learning by enabling teachers to create their own textbook supplements that cater to their own students.

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