

Do Augmented Reality Enabled Textbooks Promote Student Learning?

Steven E. QUASHA*

Abstract

In this qualitative research study, the author introduced augmented reality (AR) enabled activities into an English communication class textbook accessed by a free downloadable app via student smartphones. These AR activities ranged from the author appearing in a video explaining a key language point to supplemental listening exercises. The primary objective was to determine if new technology, such as AR, would create an impetus for students to study and review material outside of classroom hours. Student focus group results revealed that six out of 14 students used the AR app outside of class. Most of these students spent approximately 5–10 minutes reviewing the classroom language. While most of the participants expressed they were initially quite intrigued by the technology, students also remarked that more game-like activities would create additional student interest utilizing AR for language acquisition purposes.

Key words: Augmented reality, Textbooks, Aurasma, Overlays, Triggers, YouTube

Introduction

After the launch of Pokemon GO in the summer of 2016, the world became enamored by augmented reality. Featuring location-based AR technology, Pokemon GO participants first establish their own avatar and then seek out Pokemon characters which are randomly located in and around users' towns and cities. While this social phenomenon garnered wide interest globally, many educators viewed the Pokemon GO craze as an excellent opportunity to apply AR for academic purposes.

For teachers of EFL at Japanese universities, one of the biggest hurdles is ensuring that students review and study English outside of class. Systemically, there are many barriers such as excessive work hours at part-time jobs, daily club activities, and the inevitable reality of socialization that hinders students' ability to dedicate time needed for learning outside of class. However, creating an impetus for students to become more curious and interested in learning useful English was one of

* *School of Modern Management, Department of Modern Management*

the main objectives for this research.

Another reason for this study was to determine if AR can be viewed as a viable learning tool for foreign language students. Would students find AR materials engaging enough to use the app every day, or at least a few times per week, outside of class? Moreover, another goal was to help EFL educators better understand which materials were deemed worthy by the end user, or students themselves. It is the author's anecdotal experience that educators often create materials which they perceive to be essential for learning, yet quite often these materials receive a lukewarm response by students. This focus group study aims to bridge this gap and hopes that readers will be able to learn the best way to apply AR into their own classroom environment.

An additional objective for this research was to incorporate some fun and excitement into the classroom by using AR. If Pokemon GO can create such a wide global following, perhaps using some elements of AR will have a similar effect on students. Therefore, the far-reaching goal was for students to have fun while being on task using the target language. Lastly, I chose this study to also help educate myself about creating augmented reality content. Learning how to embed AR files into a textbook was, at first, a rather daunting task. However, like so many things in life, trial and error eventually lead to positive results at an ever-increasing pace.

Literature Review

Although Pokemonn GO took the world by storm a mere two years ago, readers should note that the field of augmented reality existed long before that. In fact, earlier technological incarnations began decades ago and evolved into the system we have today. In 1992, the United States Air Force created training material known as a virtual fixture system in their Armstrong Laboratory (Rosenberg, 1992). As far back as twenty-five years ago, government and industry recognized that AR offered numerous applications for simulating a variety of outcomes for military personnel. This has migrated into the civilian world because AR has significant value with its ability to bring elements of the digital realm into a person's perception of the actual world. In simpler terms, AR users are drawn into the technology since its components appear as part of our real world. This makes it an optimal training method since AR users are forced to react when they are faced with augmented visions of reality.

In the education realm, Bower et al (2014) surmised that augmented reality will cause a cataclysmic shift in the way we learn. Although the authors of this study initially targeted the visual arts, the notion of students designing their own AR experiences to develop higher order thinking skills offers vast potential for a myriad of academic fields. One key factor from this study was that AR can help reduce cognitive overload by providing students with more level appropriate scaffolding to match the ability of individual students. With AR being adapted as a learning tool, teachers may no longer be faced with such wide learning gaps among students in class. This learning environment could lead to higher engagement by students regarding course content along with increased levels of motivation.

A simple application of AR is evident in the recent boom of global positioning satellite (GPS)

based games. One merit of GPS games is their ability to be highly customized for specific classes or activities. An example of this is an AR campus tour app created by Liu and Tsai (2013) to assist students that were learning English. In this particular app, students aim the camera at one of the many campus spots contained within the AR app. Then, after clicking one of the locations, text information appears as an overlay on the screen of the user. This function enables students to find out more detailed information about the various spots on campus using the AR app. In this activity, learners acquire more information using their English language skills while also playing a game by seeking out additional locations on campus.

As Godwin-Jones (2016) mentioned, there are a number of reported projects that use marker-based AR to help teach vocabulary: ranging from developing flash card applications for English language students (Li, Chen, Whittinghill, & Vorvoreanu, 2014), to English-Tamil translation (Rose & Bhuvaneswari, 2014), including helping learners with the pronunciation of English words (Solak & Cakir, 2015), as well as vocabulary acquisition in Tagalog and German vocabulary (Santos et al., 2016).

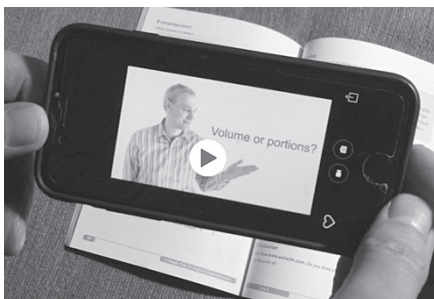
One area in AR that will likely warrant considerable attention is place-based games which—as its name implies—puts the learner in a more active role by using the target language to read, listen, speak, and write as the user navigates through the game. An example of this is the mobile game for language learning called *Mentira*. This murder mystery game was designed in 2009 to teach Spanish pragmatics to intermediate-level learners (Holden & Sykes, 2011). Played over a span of three to four weeks, *Mentira* combines classroom activities, independent gameplay, and a site visit for users.

Methods

To promote AR for English language acquisition, the author used overlays in the third edition of his textbook to create both classroom activities and supplemental material for students (Quasha, 2018). The app chosen for AR was called Aurasma, but the company has since changed its name to HP Reveal. The primary reason for choosing this app was its cross-platform capability and that it was a free download for both iOS and Android users. Additionally, Aurasma reputedly exhibited fewer technological shortcomings than other competing apps in the burgeoning AR arena.

To date, Aurasma has been utilized in a wide array of language learning applications (Driver, 2016; Valle, 2014). Previously, Ogata, Yin, El-Bishouty, and Yano (2010) showed how Aurasma was effectively used with student-designed short videos clips for teaching the French language. For any of these AR applications, overlays serve as the content driver for augmented reality. As Hawkinson (2014) points out, AR files can be either audio, video, text-driven or animated. Additionally, they can be a combination of formats. Once each file is designated for a particular page in the textbook, an established trigger on that page must be established. The trigger itself should be an image since the Aurasma app is better able to identify images rather than text.

The student is then able to launch the Aurasma app and move their smartphone camera to find the trigger on the page which will launch the AR file. An example of an AR movie file that helps to



explain a vocabulary point is displayed in the image on this page. Since students are searching for a trigger on one specific page, having more than one AR file per page can be challenging.

Subjects for this research study comprised of 14 first-year business management students at a Japanese women's university. English is a required subject for all first-year students and participants were selected on a volunteer basis. Three student

groups were created from different English classes and each focus group consisted of 3–4 students. Each group gathered at the same time during the fourteenth week of the school semester. The teacher served as a moderator for each group by distributing the focus group questions and translating any misunderstandings after students read each of the questions to their group partners.

A series of six questions were administered to each group and students were instructed to write down their individual answers before discussing them with the group. After each group discussed their answers for 10–12 minutes, one student was selected by each group to write the group's answers on the board. Each selected representative from the group then wrote the answers on the board at approximately the same time. This is a method that all of my students have experienced in class over the course of the semester and the author believes that it helps limit students from copying another group's answers.

Results

A list of the questions used in this study can be found in appendix A located at the end of the paper. The first question asked students about their impression of the AR material. This served as an open-ended question. The top words for student answers that appeared on the board for this answer were; newest or the latest technology, trendy, high-tech, and that it seems like Pokemon GO. These answers seem to indicate that students felt that utilizing AR was a foray into the world of high-tech learning. Many, if not most, of them had experienced playing Pokemon GO, so AR may have been viewed as an extension of that.

The second question asked students if they used the Aurasma app outside of class. Out of the 14 participants, only six of them used the app beyond the classroom. As a follow up question, students were asked why they did not try using the app. Those students responded they were either too busy or simply forgot. Readers should be aware that most first-year Japanese university students will take an average of 12 different classes per week. Consequently, it can be a major challenge juggling a variety of courses, with a part-time job, and possible social activities for most of these students.

As part of question two, students were also asked: How often did you use the app outside of class? The six students responded they spent an average of 5–10 minutes looking at the Aurasma app material throughout the week. As I recalled my memory of Pokemon GO users walking around aimlessly searching for characters at all hours of the day, this result was somewhat disheartening.

However, I did appreciate students' candor and feedback about the AR material introduced in class.

The third question asked students if they felt more motivated to study English with the introduction of the AR app. Student answers were as follows: a little, at first, and if there is video, it makes things more interesting. One takeaway from this question is that students seem to be more receptive to video content versus text or audio files.

The fourth question queried whether the app helped students learn more English. Some of the student answers that appeared on the board were: Not so much; But, for more information, it was OK; Maybe for review. Here, students clearly did not believe that the AR files helped them improve, but the content was perceived as a possible tool to help students review classroom vocabulary.

Moving to the fifth question, students were asked: Which AR materials did you enjoy the most? Students first choice was videos of people. When asked for further detail, students preferred interviews with people. For instance, for the reading section about the food spice known as sriracha, I conducted an interview with a chef who described ways he uses the spice in his cooking. This example of bringing the textbook alive with content to extend the activity seems to be a preferable AR textbook application. Another area that students mentioned were explanations for certain phrases and cultural points. These were videos of the author showing sample sentences with further explanations. A photographic image of that particular type of video appeared earlier in this paper.

The final question asked students: What would improve the AR content for this class? Answers varied widely and included the following responses: Make it more like a game; fun activities; do AR with my friends; have snap chat features. These answers offer AR developers of educational materials excellent insight into the minds of our end users. Students today want AR in the classroom to mirror what is available in the gaming or social media world. Activities should be fun, engaging, and users want to have the ability to share their files with friends.

Discussion

Before educators embark on an AR program in class, it is imperative to understand the technological issues that will arise. First, teachers need to allocate enough time for students to download an app in class. There will be some, or perhaps many, students with a limited mobile phone data plan. This will prevent them from downloading any files during class. For these students, teachers will need to pair them up with a student that can download the app.

Next, when students lose or buy new phones, they will likely forget their login name and password for using the AR app. From the very first day, it is crucial to have students write down their login name and password information and send that file to an email address for safekeeping. Another bottleneck is that the AR app registration site is entirely in English. Most students have probably never tried registering using a webpage or app in a foreign language. Therefore, students will require screenshots of each step to help usher them along in the registration process. Showing each step either on a computer-enabled projector or via a flat screen TV in the classroom is an effective way to help teachers facilitate this process.

As previously mentioned, while my classes were using the Aurasma app, Hewlett-Packard inexplicably changed the name of the app to HP Reveal in the middle of the semester. This caused some major roadblocks for both the end users and for the author. On my end, I scrambled to portal all of the Aurasma files over to the new HP Reveal site and instructed students to create new login names and passwords. Typically, this announcement was greeted by a chorus of student groans as the AR app inadvertently monopolized our classroom instruction time. Needless to say, this hardly promoted a stable environment for introducing students to augmented reality. In fact, it could be one of the contributing factors why so few students elected to access the AR files outside of class.

Although the student responses in this qualitative study were not overwhelmingly positive, it has helped me develop more realistic goals for using AR content in the foreign language classroom. One activity that should work well is a class treasure hunt. For this location-based activity, students could work in small groups and receive clues in English all around campus at predetermined locations. An AR app and a smartphone are the only necessary tools for students to carry. Another activity that might be worthwhile is creating some interesting vocabulary games. Lastly, since AR is synonymous with animated characters, academic content needs to mirror commercial programs. For educators lacking the technological skill set to develop animation, one possible route is to outsource AR projects to either the Freelancer or Upwork website. On both of these websites, there are many freelance animators and skilled AR developers willing to work for reasonable hourly rates.

Perhaps an even more compelling approach toward introducing AR into the classroom is having students create their own content. Today's students are likely more technologically savvy than the majority of educators, therefore teachers may want to avoid guessing which content most appeals to students. Instead, have students work together to create AR projects to share and compare with other groups in class. Such an active learning project would promote technological skills, team building, and promote student accountability.

Future Implications

Although it is admirable for educators to attempt to stay ahead of the technological curve, teachers must remember that we are at the beck and call of our students. Even though Pokemon Go was an international hit in the summer of 2016, it could be soon become nothing more than a fad. This is not to say that AR will vanish into thin air. Rather, it will continue to evolve for users on a more personal level. Having done my best to learn new technology to create the AR triggers and files, I believe the majority of educators will be unable to create comparable game characters for educational purposes. The reality is that commercial developers have far too much of a competitive advantage over full time educators. The two main points being time and money to develop better AR applications. Hence, my recommendation that outsourcing AR files might be the best choice for overscheduled teachers.

Due to the technological trials and tribulations expressed above, I chose to portal my collection of AR files over to YouTube after completing the research for this paper. Since a large percentage of

students watch YouTube on a daily basis, there is no technological learning curve for the end user. Any student with a smart phone can access the YouTube app. More importantly, the YouTube platform offers a high level of stability compared to untested AR apps. When students wake up each and every day, the YouTube channel will be there. Therefore, rather than introducing an AR app in class, my students today simply click on a QR code embedded in the textbook which then links to a YouTube video for that topic.

This approach has proven to be much easier to implement in class than augmented reality files and, while it might not produce the same initial student remarks of “wow, cool,” it does deliver content that allows students to review outside of class. In retrospect, I believe that my initial goal of using AR to help students review and learn outside of class has been supplanted by the YouTube channel. The only setback is that YouTube is more of a passive form of learning, but having students create their own videos is also a potential learning tool that can be explored.

Armed with so many different forms of educational technology, teachers must decide the reason for introducing technology into the classroom. If it is to be used as a learning tool, AR offers some wonderful possibilities such as treasure hunts and student-driven content. Producing a more game-like program, such as Mentira, would no doubt benefit students at all levels of foreign language instruction. However, for reviewing material and explaining vocabulary points, the author believes that YouTube offers a more stable platform and remains a brand-name online product that students both know and trust.

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Appendix A

1. What was your impression of the AR material introduced in class?
2. Did you use the AR app outside of class? If so, how many minutes or hours per week?
3. Did you feel more motivated to learn English with the introduction of the AR material?
4. Did the app help you learn more English?
5. Which AR activities did you enjoy?
6. What would improve the AR content?