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Augmented Reality: Exploring Its Potential for Extension

Abstract

Augmented reality (AR) is quickly becoming commonplace in our daily lives and in many information-sharing fields. This article addresses how Extension is exploring its application and utility for our consumers. In the article, I provide a clear definition of AR and an explanation of how it differs from virtual reality, followed by examples of AR applications within and external to Extension. I describe the origin of, development process for, and lessons learned from an eXtension Foundation–funded AR project in the hope of offering a roadmap to others. Additionally, I present findings from a statewide survey of Extension professionals about AR's strengths, weaknesses, and potential.

Keywords: augmented reality, innovation, technology, family and consumer sciences

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Introduction

Picture this: As you read an Extension publication, credible and interactive content "magically" appears alongside the text. Technological developments are quickly making such an experience possible, with augmented reality (AR) poised to lead the way. AR's ability to provide real-time solutions by projecting layers of information on real-world environments may create more meaningful user experiences.

It is nearly comical to envision our daily work without technology. The ubiquitous nature of the Internet, mobile technologies, smartphones, email, and so forth has indelibly changed how we conduct our work, as well as the work itself. For instance, social media has become an often-used and accessible resource through which Extension professionals can recruit, communicate with, and engage consumers (Allen, Jolly, & Barnes, 2016; Barnes & Coatney, 2016). As technology progresses, so should Extension's use of it. AR is only one technological resource in its infancy of application within Extension. However, unlike some field-specific technological developments (e.g., drones, biotech), AR has the potential to influence multiple realms of Extension, such as

agriculture, family and consumers sciences (FCS), and 4-H.

AR Defined

The core technology detailed herein is AR, which differs significantly from virtual reality (VR). Kroll (2016) provided working definitions of AR and VR, stating, "Augmented reality (AR) is creating layers of digital information on top of the physical world that is viewed through an Android or iOS device. Virtual reality is different in that it is a computer simulated environment that replicates the physical world" (para. 2).

Innovation and Outreach

Innovation is an integral value of Extension, dating back over 100 years and woven into our deepest roots. The *Journal of Extension* has detailed the evolution of technology's influence on Extension educators' work since Levine's 1995 article sharing the imperative for professionals in our field to embrace technology's presence and potential. Extension professionals began to answer this call by detailing uses for the Internet (Swann & Einstein, 2000) and finding that users prefer accessing Extension education through virtual versus in-person means (Rodewald, 2001).

Extension has a rich history of reaching people where they are with research-based information applicable to their daily lives. Outreach is our pride, mission, and expertise. While audiences continue to access research-based information through county and state Extension resources, the availability of information found online serves as a competitive force. Hosting information in a real-time, accessible format that requires little of the user other than what he or she already has available is essential to continuing our mission. Using AR technology to extend knowledge directly to consumers integrates and embodies Extension's innovation and outreach mind-sets.

AR Innovations

The field of general education is one of AR's earliest and most prolific adopters. In 2016, Huang, Chen, and Chou detailed the development of an AR venture that animated the eco-education experience and indicated that using AR had increased learner engagement and learning outcomes. Also in 2016, Akçayır, Akçayır, Pektaş, and Ocak showed that using AR in physics laboratories increased college students' skills and positive attitudes toward learning the content. Pokémon Go (a commercially derived mobile AR game) has been adapted for purposes of increasing youths' levels of physical activity (LeBlanc & Chaput, 2017) and increasing participation in 4-H programs (Kroll, 2017) and other forms of social engagement among adolescents (Ruiz-Ariza, Casuso, Suarez-Manzano, & Martínez-López, 2018).

Extension professionals also are beginning to experiment with varied uses of AR. For example, it has been used for teaching topographical map basics, landscape change, and hydrology and for enhancing an Iowa State University 4-H nutrition publication (Welch, 2017). The work of Ferrer-Torregrosa, Torralba, Jimenez, García, and Barcia (2015) and Nadolny (2016) detailing the positive impacts of integrating AR and standard print documents supports the hypothesis that integrating AR into educational settings increases user engagement and, potentially, the understanding and application of concepts.

Project Description

To further development, testing, and adoption of new technologies such as AR, the Extension Committee on

Organization and Policy published a report defining innovation as "the process of improving, adapting, developing, or creating a new product, system, service, or process, large or small, to deliver better results, create value for people, or move an organization forward" (Smith et al., 2016, p. 12). In support of this call for innovation, eXtension Foundation, with its focus on serving as an innovation and resource hub, selected and funded nine projects (out of 49 applications) regarding exploration of innovative mechanisms for delivering research-based content to ever-evolving clientele. This article details efforts and findings related to one of those projects, on which I was a team member.

The purpose of the project was to explore the utility of AR within Extension in service to consumers. Specific objectives supporting that mission were as follows:

1. Identify priority areas of FCS information that AR can address.
2. Identify resources suitable for facilitating the use of AR.
3. Create AR-enabled Extension resources.

Development Process

AR software and user-friendly programs are still emerging, and, when our team wrote the eXtension proposal, Aurasma was the leading platform through which to create and deploy AR-enabled content and was the inspiration for applying content in the context we were proposing. We began by testing the Aurasma app with readily available Extension materials and publications. We determined that at the time Aurasma's software and interface were not intuitive for novice users. We also found the software to be highly unreliable and unstable. Furthermore, problems existed regarding the interaction between Aurasma and institutional software permissions, and Aurasma was not accessible via Android-based devices. Consequently, we turned our attention elsewhere and found Layar, another software option similar to Aurasma, to be conducive to our project, following extensive testing and conversations with the software's developers.

Content Selection and Capacity Building

After discussing initial ideas with nearly 30 Extension FCS agents in Tennessee, I determined it was best to pair the AR technology with the publication *Let's Talk About It*, which I also authored. This publication is a guide to help parents navigate conversations about sex and puberty with their children. The publication contains photos that serve as "triggers," leading the user to additional, often interactive, content. In this example, the triggers directly connect the user to videos elaborating on the content and/or to additional resources and websites. In other uses of AR, triggers may have different results, such as producing a 3-D image. To understand what occurs, imagine a QR code, but instead of the black-and-white pixelated boxes, there is an image (trigger) that can be "scanned" using an AR app on a device such as a smartphone. When a user highlights a triggering image using an AR app, whatever is linked to the source image appears on the user's device. For example, a user "scans" a photo using the Layar app, and a website immediately displays or a video begins to play on the user's phone. State specialists trained student workers to use the AR platform after final content selections were made.

Lessons Learned

Many small insights were garnered along the way, but three key points stand out as those to consider when using

AR to enhance Extension work.

First, it is important to include instructions explaining the AR resource to users. AR uses images (versus QR codes), and because of this, if there is not some form of indication to the user that the content is enabled with AR, the entire effort may be rendered invalid.

The second lesson to share with future AR innovators pertains to the selections of images used as triggers. Linking AR software to stock photography and videos hosted on third-party websites is not ideal. Having original content ensures that others cannot duplicate and "reroute" the AR trigger. Additionally, linking to original videos hosted on a home server ensures that consumers are not unintentionally exposed to unsolicited content via advertisements.

Third, using appropriate publication content is vital. Some people may view the information provided in *Let's Talk About It* as sensitive in nature due to its references to sex, puberty, and sexuality. Tennessee public school systems must abide by state law mandating abstinence-only sex education. Because of this, we were not able to widely distribute the AR-enhanced publication for pilot testing with parents and youths as originally intended. My suggestion for future innovators is to pair the technology with information and materials most people would find approachable. Pairing novel technology with commonly known information may increase testing by large groups and reduce hesitancy related to early adoption.

Evaluation Method

Extension agents throughout Tennessee were given the opportunity to use the AR-enhanced publication and provide feedback about it and AR technology in general. All Tennessee-based Extension personnel (N = 975) received a link via email to an online Qualtrics survey containing both descriptive and qualitative questions about the publication and AR technology. By the end of the data collection period, 125 Tennessee Extension professionals had completed the survey. Three responses were incomplete and removed from analysis, resulting in a final sample of 122, or a 12.5% response rate. Each participant had the opportunity to enter his or her name into a random drawing for an iPad Air, charging cord, case, and stand.

Findings

Our team ran descriptive statistics derived from quantitative questions using the software internal to the Qualtrics program. Of the 122 valid responses, 47.2% of the respondents identified themselves as Extension agents, 13.6% as Extension specialists, and 1.6% as consumers; 21.6% considered themselves to be in the "other" category.

Most participants (68.8%) were female. Almost half (48.8%) had a "professional degree," nearly 17% had a 4-year college degree, and 12% had a doctoral degree. With regard to the most substantially represented age groups, 26.3% of respondents were in the 18–26 age range, 15.8% were in the 37–50 age range, and 14.9% were in the 51–60 age range. Only 5.8% of respondents reported not owning a smartphone.

Most respondents (78.7%) reported that they had never used AR, and 9% were unsure whether they had. Respondents were equally split between "definitely, yes" (50%) and "probably, yes" (50%) regarding whether they wanted to see more AR integrated into future Extension publications and programming.

An Extension specialist in the university's FCS department initially analyzed the qualitative responses using the constant comparison method (Ryan & Bertrand, 2003). This analysis included conducting an initial reading of all

qualitative responses followed by coding content using participants' repeated and key phrases/terms. These high-frequency phrases/terms were keywords used during the Qualtrics-generated qualitative analysis. The Extension specialist further validated the program's coding by rereading each response, looking for any overlap or discrepancies—of which there were none. As the principal investigator, I then replicated the entire process. There were no differences between our findings, indicating fully validated and triangulated findings.

Strengths, Weaknesses, and Potential

Responses about AR technology fell into three categories: strengths, weaknesses, and potential. Multiple themes within each category offer insight into how Extension professionals are thinking about AR.

Strengths

AR strengths identified by respondents centered on two themes. The first was that AR is fun and interesting. Representative comments are "[AR technology is] new and interesting, especially with youth audiences" and "AR makes the resource material much more interactive and interesting." The second theme focused on increased engagement. For example, one participant said AR could "increase engagement" and noted that use of AR "gives the ability to provide much more information than would normally be possible in a brochure, for example." Another participant made the following statement: "Interactive techniques allow deeper exploration of content. For most people seeing something work is much better than reading [about] how something works. I believe this would be great to enhance text-based publications to help folks better understand the information being presented by presenting it in a more visual way or allowing them to see and touch at their own pace and in their own way."

Weaknesses

The two themes that defined the AR weaknesses category were lack of knowledge and lack of resources. One participant's comment about lack of knowledge captured the sentiment of many others: "The weakness is the unfamiliarity with the [technology] for the general public. You have to provide instructions for the downloading and utilizing [of] the app. For most people, they will not pause long enough to do this. The technology is just not frequently used enough in daily life." Numerous participants noted the potential lack of resources, with comments such as "not everyone would have equipment to use." On the basis of context clues, we surmised that it is likely that the theme of lack of resources pertained to end users (consumers) versus content creators who would develop AR-enabled products.

Potential

This final and most robust category pertained to the potential of AR as it relates to Extension education efforts. Key themes included increased accessibility for clients and better learning opportunities for those with diverse learning styles. One participant said, "Especially with Layar, you can add different formats into the image, so it could be geared towards a specific disability. You could have many different formats of the same publication." Additional comments underscored the importance of understanding the audience. For example, one participant noted, "It is extremely important to make sure that resources adapt to the learner. By making sure that learners have technology that best suits their disability or learning style, one is ensuring maximum learning possibilities." And another said, "Perhaps if someone has a reading disability, the phone/device could take certain text and

populate a picture of the selected text."

Implications

Research

In the future, researchers should investigate the congruence of perspectives across respondent types (e.g., content creators, sharers, users). Understanding users' needs and perspectives permits software refinement. A few respondents noted that AR was unlikely to be embraced by older consumer cohorts. Given that Extension intends to serve all regardless of age, this point warrants attention. Extension would benefit from better understanding whether differences exist regarding AR use and value across generations and, if so, what those differences are. According to the Pew Research Center (Patten & Fry, 2015), millennials are better educated than previous generations. Thus, we can expect this generation to recognize the importance of evidence-based information that is of direct application to their lives. Additionally, more millennials are working as compared to members of previous generations and, thereby, are experiencing greater demands on their time and a greater need for instantaneous information (Patten & Fry, 2015).

Practice

An implication of our project could be the deepening of Extension's impact on people's daily lives if we in Extension consider how to provide AR-enhanced learning opportunities that are applicable to real life, in real time. Such work could lead to the ability to harness Big Data for the purpose of monitoring trends that Extension specialists then could rely on to create responsive and cutting-edge resources.

Additionally, AR has the potential to increase Extension's ability to reach new audiences. For instance, a narration and translation option could support use by those whose first language is not English or who may have low literacy skills. This implementation of AR would greatly extend the reach of Extension by providing a means through which underserved populations could access valuable information.

Envisioning and Preparing for Tomorrow, Today

Extension is an institution dedicated to real-life solutions. As technologies, and the individuals using them, advance, so must our approach to outreach and engagement. For example, imagine being able to scan a staircase and have the eXtension Reality Augmented (eXtRA) app provide you with research-based ways to ensure home safety. With relationship education at the core of FCS, it is easy to picture a parent using a mobile device to record a fitful child and the app presenting an expert sharing information about how to respond. Following the presentation of the solution, the eXtRA app could connect the parent to other parents who have experienced similar situations, creating a shared community of support, which is highly beneficial to optimal family functioning (Ha, Greenberg, & Seltzer, 2011). Perhaps the most pertinent example of using AR is in the grocery store. For instance, a consumer could scan a bar code on a package using an Extension app dedicated to helping people make healthful food choices. That simple action could result in a report about the food's nutritional content and how it pertains to one's wellness plan.

These opportunities would create new sources of revenue related to harnessed data generated from inquiries, licenses for adoption and use, app fees, advertising, and consulting. The work described here capitalizes on using ready and available resources of eXtension Foundation partners and land-grant institutions across the nation

rather than outsourcing or burdening the system with the need to create new content. Extension's valuing of innovation continues to be alive and well. In that spirit, professionals in our field are interested in and willing to explore the technology. However, we must use caution when developing new applications of AR. Honoring the varied technological abilities of content creators and end users is key.

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