

Augmented Reality, Multimodal Literacy and Mobile Technology: An Experiment in Teacher Engagement

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ABSTRACT

The use of AR in education has already been found to be valuable although its use presents technical and management difficulties. The reality is that teachers often need to be enticed by a tempting range of potential benefits before investing precious time and effort in new technology. Challenges can cloud vision of greater potential. This ongoing project, essentially an experiment in encouraging professional learning, is proving successful in engaging educators with leading edge AR technology. Such an activity can provide a multi-dimensional catalyst for addressing a host of demands that face typical Australian teachers, particularly integrating mobile devices and multimodal texts in teaching and learning. The project – incorporating the location-aware *FreshAiR* app, Quick Response codes and image-triggered *Aurasma* – has been undertaken voluntarily by some Independent Schools in Western Australia. It includes developing teacher skills with AR (and other apps) and the development of a “model” AR tour (excursion/field trip). The experiment has generated trans-national collaborative conversations, positively impacting on both professional practice and app design. Participating schools have already provided valuable feedback that supports and expands existing research and perhaps generates some new ideas. The AISWA project has been funded by the Australian Government Quality Teacher Program.

Author Keywords

Augmented Reality, mobile devices, FreshAiR, Aurasma, Quick Response (QR) code, multimodal text, literacy, integrated curriculum, professional learning, EPICT Australia, AISWA, AGQTP

INTRODUCTION

This is not an “academic” research project. It describes a practitioner’s case study centred around motivating teachers to try various augmented reality (AR) activities to support integrated curriculum and a ubiquitous incorporation of multimodal texts. It was recognised that the concept of AR “tours” (excursions) also had merit for engaging teachers with more creative utilisation of available mobile technology and learning spaces. The intention of this experiment was to find a way to encourage teachers to explore and experience this valuable new teaching tool – one with broad curricular and pedagogical possibilities - while accepting that it also presents some challenges. To support the level of professional risk-taking required, a lead-by-example curriculum-rich “model” AR tour was developed and offered to schools, along with teacher ICT skill training workshops around building multimodal AR texts and creating digital journals on mobile devices. Ongoing support for participating teachers was offered, encouraging teachers to ultimately create their own authentic, context-relevant AR activities and excursion-based multimodal digital texts. The response has been promising. During a five month period almost 170 students and 11 teachers have participated in five different versions of the AR tour, providing enough feedback to inform this practitioner’s paper. The teacher “skills workshops” (ePubs and AR apps) have been well subscribed (about 80 teachers to date across both). More tours, workshops and school-based projects are scheduled over the next 18 months. Examples of related student and teacher work will be collected as they are produced.

Benefits and Barriers

Augmented Reality – annotating, complementing and supplementing real situational experience with “virtual” web-based content/experience – is reported to have many potential benefits for use in education. Research suggests that using AR can make learning personalised, student-centred, constructivist, participatory, collaborative, interactive, cognitively rich, media-rich, creative, challenging, problem/solution based, contextually relevant, authentic, meaningful, engaging, enjoyable and motivating (Dunleavy, M. et al, 2008; Fitzgerald, E. et al, 2011). With this list in mind, educators could envisage significant pedagogical value in using AR. Authentic, intentional and purposeful use of technology is at the very core of learning and the use of mobile devices as truly mobile devices really leverages their features.

However, the benefits from using AR do not come without inherent challenges, especially when using location-based AR on excursions (field trips). The documented barriers to considering adoption include the users’ (or designer’s) skill level, confidence, familiarity with their devices, persistence and problem-solving ability; the technical and connectivity issues (including limits on scan sensitivity, GPS tolerances and quality of connection to 3G networks or wi-fi); environmental distractions/challenges; possible cognitive overload for users; and, importantly, seeing relevant connections when linking the AR activity with good pedagogy and curriculum content (Dunleavy, M. et al, 2008; Fitzgerald, E. et al, 2011). In addition, practical experience working in schools indicates that there are additional familiar challenges to implementation. These include the limitations of time and technical support, obstructive policies around the use of

personal devices (especially mobile phones) and the growing logistics of undertaking class excursions. Teachers also express concern about “wasting” time with “fun” activities and a lack of confidence in their students’ abilities to cope with independent, technology-based tasks where lack of traditional structure is involved. There are also often issues around equity, duty of care, accountability and parent perceptions that influence adoption of initiatives. It is fair to say that, to make *any* ICT adoption or change attractive and sustainable, the perceived “cost-benefit analysis” must significantly work in favour of any proposed change.

THE PROJECT STRUCTURE

The Context

In the last few years, Australian Government initiatives have generated massive changes to education – new Australian Curriculum expectations (including mandatory integration of ICT as a “general capability”), far greater availability of 1:1 (personal device) mobile technology in schools and explicit and assessable national Teacher Professional Standards (which include one’s capacity for utilising ICT). There has been a restructuring and re-definition of the school years 7-10 (Middle Years) as a critical area of education. A new “Digital Technologies” subject is currently in draft form. Many of our schools now participate in EPICT Australia training (supporting pedagogical use of ICT in teaching/learning) and are keen to complete the new EPICT “Mobile Technologies” module as part of their Licence or Portfolio accreditation.

With these drivers in mind, the intention of designing this experimental AR Project was to tempt participating teachers (or other extended audiences) with some motivating evidence that AR-based activities could address multiple aspects of contemporary learning, particularly for the Middle Years (7-10). Middle Years is where there has been the greatest investment in 1:1 technology in Australia. These teachers are under pressure to accommodate technology. The needs of this “early adolescent” cohort have also been well identified (Boyd, J. 2001) and lend themselves perfectly to the features of team-oriented, contextually relevant, media-rich, technology-based experiences and follow-up activities.

Examination of the Australian Curriculum subjects reveals multimedia creation and multimodal text types as ubiquitous suggestions for ICT integration. Building an excursion where students can collect media and information for later use in digital journals can provide an extra layer of opportunity for integrating the use of other mobile devices plus help to direct student focus during the excursion. In addition, “computational thinking” and programming expectations of the (draft) Digital Technologies subject could be addressed by creating an AR tour (or a game) as an exciting, relevant way to learn sequence, logic, analysis, modular planning and other pseudo-coding skills, while also creating multimodal texts!

In summary, the project had to offer obvious value. The key considerations to target teacher engagement were to:

- encourage teachers to try a cutting-edge technology & discover the benefits; surprise teachers with new insights
- support teacher skill development, pedagogical reflection & Australian Teacher Professional Standards in ICT
- to develop a model that was scalable and adaptable for each teacher’s specific needs
- support new Australian Curriculum expectations – content, capabilities and priorities
- target early adolescent learners (engagement, social needs, leadership, relevance, independence)
- promote the importance of multimodal literacy skills for reading, listening, viewing, speaking and writing
- support more exciting ICT integration across the curriculum; use device mobility & BYOD to advantage
- model integration and transfer of skills across subjects
- provide a model for a genuinely collaborative task
- generate springboards to critical/creative thinking and richer, more creative use of apps on mobile devices
- inspire computational thinking by getting students to create their own AR activities

The AR Apps

Various QR code apps (*Kaywa*, *scan.me*, *Microsoft TAG*) and *Aurasma* (an image-trigger app) were used within the project and taught in the teacher workshops. Each uses a static image (either the patterned QR code or a pre-loaded image in *Aurasma*) to trigger web-based content. The user scans the image using the appropriate app on their mobile device and the teacher-selected predefined web-based content is launched. This content can be any web-friendly media. Creating QR codes is an “entry point” AR skill, while *Aurasma* editing requires a little more technical skill and planning.

There are various location-aware AR apps currently being used for education (and commerce). *Aris*, *Layar* and *Wikitude* are examples. They are more sophisticated than the image-triggered apps, so provide a third tier of challenge and possibility. *FreshAiR* was the product used for this project. The web-based content, and the location markers to trigger the delivery of this content, are set up via the *playfreshair* cloud-based editor on a laptop (free account required). In the field, students access this content through the *FreshAiR* app on their internet-enabled, GPS equipped smartphones. Content can be delivered to users when the pre-determined location markers (GPS coordinates) are reached. Information, multimedia content, instructions, quiz questions and reward tokens can be easily included. The app interface displays compass bearings, a “map view” (to help with location) and pin-like location markers in a “reality view” (looking through the device’s viewfinder). There is a History list (of content viewed) and an Inventory list (of reward tokens earned). All visible/accessible markers are initially seen as named blue pins but as students move closer to these markers they become bigger, eventually turning green and being “tap-able” for accessing the content. In this project, *FreshAiR* was used in “fixed location” mode but it can also be used for game creation by using the “play anywhere” mode. Furthermore, only the basic functions of *FreshAiR* were used to keep it accessible for “beginners”, although “realities”

(projects) can be structured in far more sophisticated ways by experienced editors, providing teachers with possible future opportunities for introducing programming and game design to students.

Elements of the Project

The project idea was presented to ICT Leaders from our Independent Schools. The response was positive. To encourage teacher participation, three mix-and-match options for professional learning opportunities were offered: participating in the AR Tour (excursion) with a class of students; participating in a full-day AR app skills workshop (including a demonstration tour) with other teachers; and participating in a workshop to learn how to integrate apps and digital media into “multimodal text” e-journals (see Figure 1 for details). Each option included practical activities and pedagogical justifications. Participants could select one, or a combination. The AR Tour also provided pre-tour support. Finally, EPIC participants were also able to use the workshops and subsequent class activities for completing the lesson planning and delivery assignment for Module P: Mobile Technologies.

Every aspect of the project was provided free to participating schools. In return for this opportunity, schools provided useful feedback that informed and improved subsequent provision. Collaboration with the *FreshAiR* app developers and Dr Matt Dunleavy (ROAR, Radford University, Virginia, USA) enhanced the AISWA project development and has helped inform both their research and app design. Their on-line advice and support have been invaluable and appreciated.

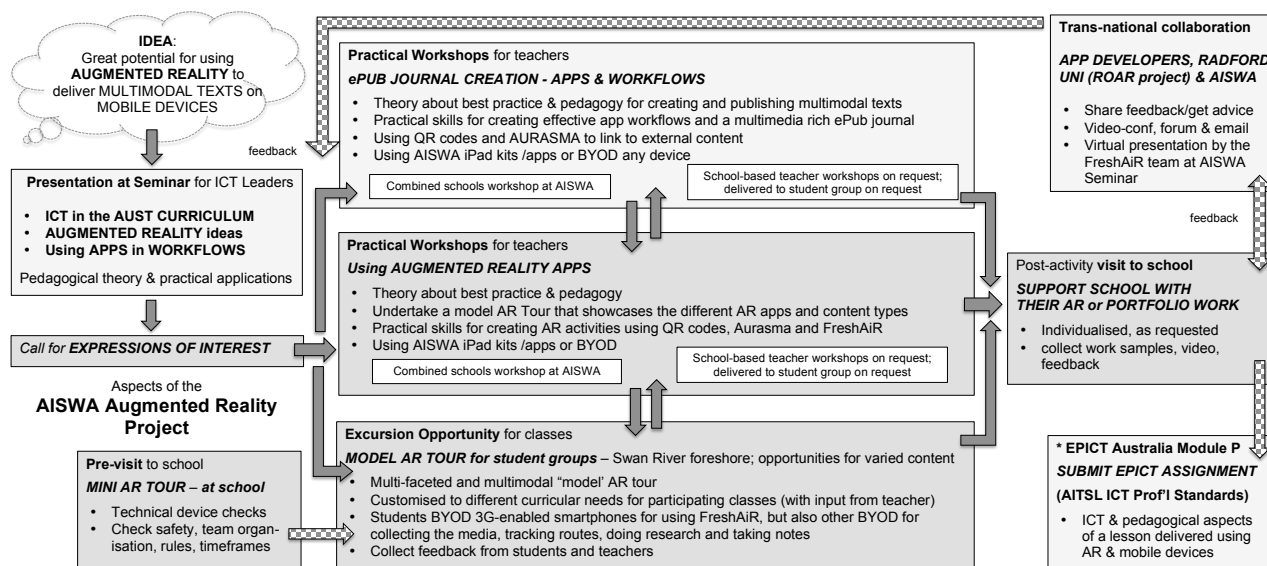


Figure 1: Flowchart showing the structure of the AISWA augmented reality project (begin at IDEA)

Teacher Professional Learning

Student AR tour

For this project, a multi-faceted *FreshAiR* AR tour was initially created on a 3km inner city stretch of the Swan River in Perth. This location was selected because of the examples of cultural artefacts, biodiversity, historical links, commercial activities, urban re-development and current affairs issues. After exploring the area and noting all the features and available teaching possibilities, an extensive list of possible content/activities was developed. As a starting point, authentic links to 12 different subject areas and suggestions for approximately 210 related activities were mapped against Years 7-10 curriculum. Subject content, and Australian Curriculum “General Capabilities” and “Cross-Curricular Priorities” were all addressed.

This was a “try before you buy” model. Teachers were able to pre-choose the content/tasks to include for their students from the broad selection available (or suggest other content), then bring their class to participate and provide feedback. The idea was to encourage classes to participate in an AR activity that might have been too challenging to develop and undertake otherwise. With support from AISWA, with minimal investment of time and risk, and without having to compromise any strict on-campus policies about using smartphones, teachers would be able to sample and evaluate some leading-edge technology in the field with their classes. As excursions in Middle School impact on teaching time across multiple subjects, ensuring the cross-curricular links were rich, authentic and relevant for Australian Curriculum was important for giving curriculum leaders the confidence to approve time spent off campus and classes missed. Teachers would also be able to experience a true BYOD learning scenario, where students have to problem-solve using their personal technology. Students would be able to use any *FreshAiR* compatible 3G smartphone (iPhone or android phone) to navigate the tour, or any other hand-held device to participate in activities *en route* (e.g. iPad, camera, audio recorder).

The AR tour was designed to be undertaken in teams and structured to promote genuine collaboration. Students in each team would need to take different responsibilities and share the learning load to succeed. Teachers were encouraged to step back, letting the groups manage themselves and take responsibility for their own learning. The content (delivered at the selected location markers) included media such as local news reports, historical images, audio commentaries, quizzes

and plain text. It included tasks such as collecting images, reading QR codes and *Aurasma* triggers, recording sounds, making observations, capturing video, reading inscriptions for clues and looking out for the safety of each other. Opportunities for “playful moments” and “fun” rewards supplemented the curriculum and added a different dimension to the tour.

Augmented reality apps workshop

This workshop included an overview of relevant pedagogy, a demonstration AR Tour in a local wetlands conservation area and practical tasks to learn how to use the three different AR apps. Every media and content type was included so that participants could see the relative functionality and value of each. Teachers were given exactly the same preparation as would be given to students in the student AR tour, so that they could experience what their students would, and discover both the joys and pitfalls. They then explored how the *FreshAiR* mini-tour had been created in the *PlayFreshAiR* editor and tried making a short tour of their own in the local vicinity. They learnt how to create QR codes and *Aurasma* triggers and how to link these to web-based content. Finally, they worked together to brainstorm ideas for using these AR tools in their classrooms and teaching.

ePub creation workshop

This workshop was designed to familiarise teachers with useful cross-curricular apps on mobile devices that could be integrated easily into an ePub app to create a journal/portfolio (a possible mobile-based follow up activity after an AR tour). Included were: apps for concept-mapping, browsing, spreadsheets and charts, graphic organisers, note-taking, sketching, painting, QR codes, diagrams, image creation, word-processing, video-editing, word collages, image editing and annotating; screen-shots, camera functions and internet access; audio recording and page design within the ePub app. The ePub apps chosen were *Book Creator* and *Creative Book Builder* (for more confident users, with extra features).

OBSERVATIONS

Within the limits of this short paper, a full description of all project observations is impossible. There were significant positive outcomes for students as well as some problems to overcome – which the students did very capably! Only comments that describe teacher engagement/perceptions related to the BYOD AR tour/texts will be presented below. Male and female teachers were represented approximately evenly, both in participation and similarity of comments.

Student AR Tour

Most teachers actively participated in selecting/modifying the content to suit their needs and all made suggestions about additional content to better suit their classes. For example, one tour was built for Year 10 “Politics and Law” and another modified for Year 8 “Indigenous Culture of the River”. One (History) teacher was inspired to build her own (successful) tour based on the model presented, and capably did so despite a self-confessed lack of ICT skills. Teachers noted that their AR tour (each customised) appeared to be very well suited to the learning and personal needs of the age group and they were “inspired” by the outcomes. They were surprised that “unexpected students” took lead roles and that the students were able to manage so well “by themselves” (with the technology and the task management). Teachers appreciated being able to try a BYOD project *outside* school without worrying about compromising (restrictive) BYOD policies and having to cope with technical issues unsupported. Every teacher ultimately liked being “allowed” (i.e. giving *themselves* permission) to supervise at a distance and let students cope “alone”, although not all began by feeling comfortable with that notion. They were all surprised at the range of devices that students brought along. (Not all devices had operating systems or GPS tolerances suitable for the app, but most teams could problem-solve this by reshuffling responsibilities within the group or sharing resources.) All said that having a “paper copy” of the tour (for emergency use) took their stress away, explaining that technology “downtime” would have been a big negative for teachers.

Teachers were also surprised that: students took responsibility for each others’ safety and were “surprisingly” supportive of each other; students showed minimal stress about technical difficulties; (difficult) weather conditions didn’t seem to distract students and walking distance wasn’t an issue for most (3-5 km) while they were engaged in the task. There was “amazement” at the possibilities for curriculum links and the many opportunities to inform activities back in the classroom (i.e. the list of suggestions provided for follow-up ICT integration on mobile devices).

None of the teachers were solely English (subject) teachers. Nevertheless, particularly interesting was a general heightened awareness (articulated in anecdotal comments) about the pedagogical value of multimodal literacies and “texts” (ways of communicating messages). They noted increased levels of engagement/reflection by various students when the content was delivered through such texts. Some articulated a new awareness about recognising potential texts, e.g. describing the outdoor location itself as “a rich tapestry of nature and culture”, and learning to “read” the messages communicated by a symbol-rich artwork about aboriginal culture and Dreaming.

Each teacher said the tour worked as an effective springboard for learning and was keen to follow up with some sort of activity back at school, although not necessarily the suggested e-journal activities. Each teacher said they would not have tried a location-based AR tour by themselves. Four were now keen to build their own *FreshAiR* tours in the future. Two wanted their students to program a tour of their own. Two suggested value-adding a “pastoral” layer to AR activities by grouping older and younger students in teams (“buddy” work) or by having a parent in each team (educating parents). These projects are ongoing at this point.

Augmented reality apps workshop

The QR codes and the basics of *Aurasma* were easy for teachers to master and all teachers expressed confidence at trying either (or both) in lessons. Editing a *FreshAiR* project challenged “entry level” teachers but was quite intuitive for those with some more general ICT experience. Every teacher ultimately articulated that they could see a variety of applications for AR in their classrooms, appropriate for their level of resourcing. The conversations were pedagogy-rich. On taking the demonstration AR tour, it was amazing to see that these teachers exhibited *exactly* the same set of behaviours, frustrations, joys, etc. as the students on the AR tour. What an excellent “reality-check” for managing their own classes! One point of difference –students were generally *better* at solving the problems. A good point for professional reflection, perhaps? Teachers (correctly) concluded that students should have the opportunity to “play” with any of the AR apps before genuinely focused and purposeful use could be expected – play being a fundamental part of learning, at any age.

ePub creation workshop

This has been the most well-subscribed workshop, probably because of its relevance for capitalising on 1:1 devices right across the curriculum, using the AR included as a springboard or not. Teachers seem to have been genuinely surprised by how easy the ePub apps have been to use and how “manageable” it is to develop rich workflows and creative multimodal texts by using such a variety of apps already on the device. No teacher has submitted an ePub journal based on an AR tour yet, although the intention was articulated and many have incorporated this into other topics and activities.

CONCLUSION

The teacher response has been positive. Students seem to have genuinely engaged at many levels with the mobile AR activities, the “outdoor classroom” and the differentiated multimodal delivery of content. Participating teachers have been very encouraged by this. It is expected that through this project, and the growing collection of AR-based examples that come from it, more teachers will begin to sample this new technology and participate in some valuable, pedagogy-rich opportunities that they may have otherwise dismissed. Seeing examples of what their colleagues have done will hopefully generate some curiosity and the confidence to try the project (or the technology) for themselves. There is great potential for developing broader, deeper literacy and thinking skills through engagement with multimodal texts, capitalising on the access students now have to mobile technology. The feedback suggests that augmented reality activities *can* address the entire range of pedagogical “key considerations” listed for this project. Are *you* tempted to “have a go”?

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