

# Nyungar Place Stories Pilot: using augmented reality for Indigenous cultural sustainability

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This paper describes the development and piloting of a project that uses augmented reality to support the cultural sustainability of Aboriginal Nyungar peoples of Western Australia's South Western corner. *Place* narratives are a central part of Australian Indigenous culture and knowledge, and the significance of *place* is critical to Aboriginal people's health and well-being. This pilot project examines the efficacy for the augmented reality app to present Indigenous narratives in a way that engages students in reflexive practice.

Keywords: Augmented Reality, place narratives, cultural sustainability

## Introduction

This paper describes the pilot of a location based augmented reality project, which triggers Nyungar place narratives in geographical locations, to support a unit on Indigenous Cultures and Health aimed at developing health professionals with cross-cultural capabilities. Nyungar (alternative spellings includes Noongar, Nyoongar and Noonga) are the Indigenous peoples of the South West of Western Australia, including the Perth metropolitan area that is the geographical and physical location of this project.

The Indigenous Cultures and Health 130 (ICH 130) unit was designed and developed to highlight the significance and diversity of Australian Aboriginal and Torres Strait Islander cultures. It reflects national recommendations to provide all graduates with cultural competency by embedding Indigenous Australian knowledge and perspectives within a culturally competent pedagogical framework (Universities Australia, 2014). This project leveraged the affordances of mobile technologies and augmented reality to create hybrid spaces that overlay real places with media that articulates Indigenous place narratives. Using augmented reality allowed place narratives to be experienced in situ rather than reading, viewing or listening from a geographically removed place such as the classroom. This article contributes to research examining new and emerging mobile learning environments and the affordance of digital technologies for cultural sustainability and situated learning.

## Background and context

Cultural sustainability is imperative to future health outcomes of Australian Aboriginal peoples. It has been noted that in the face of globalization and adverse challenges to cultural continuity, cultural groups react in ways that bring a concerted gaze to cultural ideas, knowledge and practices (Schech and Haggis, 2003). Indigenous Australians, for example, have faced considerable adversity that has challenged the oral practice of passing on knowledge to present and future generations. For over sixty thousand years the physical, spiritual, social, and cultural survival of Aboriginal Australians has depended on the knowledge that emanates from stories about the land, or *country*. Therefore a strong and continual relationship with the land is imperative to the health and well-being of present and future generations of Australian Aboriginal people.

According to Saggars et al (2010) "...our culture- the complex beliefs and behaviors we acquire as part of our relationships ...predisposes us to view and experience health and illness in particular ways" (p.2). The worldview of many Aboriginal Australians encapsulates a close relationship between the idea of country, identity, spirituality and well-being. This is not to freeze Aboriginal Australians within a timeframe of traditionalist imagery but to recognize that they have struggled through recent generations to maintain, recapture and revitalize traditional customs, beliefs and practices. Aboriginal cultures have constantly been undermined and threatened by the imposition of a more dominantly empowered culture. While cultures are dynamic and susceptible to change, the main issue here is one of equity of health and well-being that emanates from recognizing, understanding and respecting co-existing cultures, ensuring that one cultural group is not unfairly disadvantaged across all social, economic, political, environmental and cultural aspects of life. Anglo-centric

culture has historically been the dominant force shaping modern Australian life. However, from its privileged position it has negatively impacted on the life chances and health of Aboriginal peoples. If Aboriginal peoples' health and well-being are to progress, then greater attention and understanding is needed concerning the importance of Aboriginal peoples' relationships with the land, language and place.

Cultural sustainability can be defined as "the ability to retain cultural identity and to allow change to be guided in ways that are consistent with the cultural values of a people" (Sustainable Development Research Institute, 1998, cited in Duxbury and Gillette, 2007 p.1). In the past the cultural sustainability of the Aboriginal people has not allowed value-driven cultural change. Recognized as the oldest continuing culture in the world, communities within Aboriginal populations have sustained the knowledge and practices of their ancestors into current generations for over 60,000 years. However, dispossession, disenfranchisement and alienation over the past two hundred and thirty years have deprived most Aboriginal Australians of the security of their relationship to their country, their culture and their sense of well-being (Eckermann et al, 2010). Aboriginal Australians health outcomes are reported to be among the worst internationally (World Health Organisation, 2008) and the disparities of health and well-being between Aboriginal and non-Aboriginal Australians is disproportionately high with non-Aboriginal Australians experiencing better health outcomes and life chances than Aboriginal Australians.

Armstrong and Weyden (2005) and Saggars et al (2010) agree that the health of Aboriginal people has always been viewed by non-Aboriginal people as something that Aboriginal people need to address in terms of their culture, or assumed lack of culture. The deficit model of health for Aboriginal people, for example, has often been viewed by the western bio-medical model to be due to Aboriginal peoples' inability to comply with the expectations and processes of the health system's functions and structure. Health professionals have challenged Aboriginal people's compliance based on their own cultural biases and seen health through their own cultural lens, making an assumption that Aboriginal people need to change their ways and become assimilated into a western cultural milieu. This disregard for, and misunderstanding of, Aboriginal culture has greatly impacted the provision and effectiveness of health services to Aboriginal people. Armstrong and Weyden claim that non-Aboriginal Australians need to *look at ourselves, our society and our health care system* and change some of our attitudes towards how Aboriginal health is viewed and treated. Central to this is the notion of attempting to understand Aboriginal culture from their perspective.

Dudgeon and Fielder (2012) emphasize that *connection to country* is the essential core of Aboriginal cultures. For Aboriginal people land, language and place hold significant meaning central to their lives. Land, language and place epitomize a living relationship that is embedded with kinship relations, belief systems, justice codes, spirituality, sexuality and gender roles, as well as physical, social and emotional well-being. This knowledge of not just survival, but the ability to thrive well, comes from and is generated by the natural resources the land provides. There is a reciprocal relationship whereby the land supports and sustains the people who nurture and respect it, who work in harmony with the land and are synchronized by the natural seasons of time and geophysical change.

Major changes to places within the city of Perth and surroundings areas have occurred more rapidly within the last two hundred and thirty years with the introduction of European and Anglo-centric over-layering of human structures and cultural interpretations of natural landscapes. Only natural cataclysms or upheavals of the natural geophysical space have exceeded the impact of European settlement on Australia's ancient landscape. Aboriginal people's ancient knowledge of these same places continues on in the stories carried on through the generations. What current groups of non-Aboriginal people experience and know of a place today is only the surface layer of what has gone before for earlier generations of Nyungar people.

According to Doubleday et al (2004, cited in Duxbury & Gillette 2007, p.4) current discourse on sustainability integrates "...both dynamic understandings of culture and the recognition that place matters because the practice that is in need of sustaining, as well as those that pose threats, happen in particular communities and in specific geographic contexts." Doubleday et al also maintain that serious discussions of sustainability require "...considerations of the dynamics of complex cultural arrangements in particular places, rather than assumptions of either peoples or their ecological contexts" (cited in Duxbury & Gillette, 2007, p.4).

### **The Place of Stories**

As Aboriginal culture incorporates a strong relationship to the land, and embedded in country is the notion of identity and spirituality, the concept of place provides a basis from which non-Aboriginal people can conceptualize differing aspects of Aboriginal culture. The experiences of *place* can contain tangible and

intangible elements that are conveyed to people, both Aboriginal and non-Aboriginal. Stories abound in places, and about places. For Aboriginal people *place* can be about spiritual and ancestral beings; the existence of plants for food or medicinal purposes; sites of heritage and events natural, ecological, social or ceremonial.

Stories bring to life the essence of the experience associated with a place. Stories provide a context and an interpretation of what is seen, heard and felt in certain places. Attachments to the place can be formed based on these experiences and stories fluently express that attachment or association. Stories are a form of communication providing messages and information as well as knowledge; stories can be encrypted with codes that instruct the ways things are to be done, or with instruction concerning the moral obligations a person may have in relation to other people; their physical environment; or to their spiritual and social practices (Julien et al, 2010).

### **Transferring Understanding to Non-Aboriginal Health Professionals**

As future health professionals progress through their first year in their respective disciplines in the Faculty of Health Sciences at Curtin University each student is required to enrol in a common core unit Indigenous Cultures and Health 130. Students in the unit examine their own cultural lens and how the way in which they view the world impacts on others. The unit's outcomes and learning objectives are to educate a future health force in understanding the important role Indigenous and non-Indigenous cultures, knowledge and experiences play in the area of health. Knowledge and understanding of diverse Aboriginal cultures assist students to examine and develop new and improved health service provision especially when in consultation with Indigenous communities. Central to the unit is developing the cultural competencies of students as prospective health professionals who can work safely with Aboriginal people and their communities. Cultural awareness, cultural understanding, cultural safety and cultural security are stages along the continuum towards more effective partnerships (Wright, 1995; Coffin, 2007; Durey, 2010). Indigenous cultures are fundamental to the well-being of Aboriginal people and surrendering or abandoning their culture to meet the expectations of a western system is both unreasonable and unhealthy. The unit's curriculum was framed by a narrative structure using personal stories by Aboriginal people as a starting point to explore Indigenous culture and examine the impact of colonization, reflecting the oral tradition of Aboriginal and Torres Strait Islander peoples.

### **Place Narratives and Mobile Technology**

The Nyungar Place Stories project was created as a resource for the ICH 130 unit to help students understand the value of cultural sustainability by providing them with the opportunity to explore the pervasive nature of Indigenous place narratives within the urban landscape. Narratives relating to specific places in the Perth metropolitan area were gathered and recorded by developing collaborations and partnerships and building relationships with local Indigenous communities, academics and Aboriginal Elders. The app was demonstrated to a number of Nyungar community members for endorsement and adjusted accordingly. The app development process embodied several assumptions and understandings. We believed, for example that for non-Aboriginal students to gain an understanding of Indigenous culture through place narratives it compelled a 'bodily' learning involvement with place. Therefore, in order for students to grasp the idea that the contemporary, densely populated urban landscape of Perth is layered with cultural meaning, a pedagogical approach was needed that would best serve the situated nature of these experiences of place. Finally, in keeping with the Aboriginal Terms of Reference (Kickett, 1995) a respectful and reflective practice was maintained throughout the development and implementation of the application.

#### **Augmented reality (AR) overview**

Augmented realities are software applications that overlay 'reality' or the 'physical world' with data such as text, images, multimedia 3D models and so forth, primarily to be accessed through mobile devices such as smart phones and smart glasses. The term 'augmented reality' is often interchanged with virtual reality however there is a distinction between the two technologies that is not often well defined. Unlike the immersive environments of virtual reality that are designed to replace the real world with a simulated environment, augmented reality supplements reality with data that coexists with the real world (Azuma, 1997). This capacity to layer the physical world with cultural artefacts that augment rather than replace was critical to the pedagogical approach because it reflects the coexistent nature of cultures and the layered meaning of places. While AR technologies have been available since the 1960s the technology for developing and using AR in early days was cumbersome and required a high level of programming skills. It is only in relatively recent times that these technologies have become within the reach of the layperson through commercial applications that can be easily populated with content and don't require programming or traditional AR skills. Due to this greater degree of user-friendliness,

educators are now harnessing the affordances of this technology for teaching and learning (see Squire, 2010; Squire & Klopfer, 2007). Indeed AR has provided broad learning opportunities across many industries such as medicine, automotive and the military (Damala, et al 2006) but also in K-12 education (Dunleavy et al, 2009; Dunleavy & Dede, 2014). As yet there are limited examples of applications of AR for higher education, particularly using location-based AR technologies and according to the recently published Horizon Report (see New Media Consortium, 2014) it remains an emergent technology for this sector.

### **Meaningful learning is situated**

A smart phone with an augmented reality app has the ability to transform the land or cityscape into narrative spaces by linking objects such as buildings and landmarks with websites, wikis and other online technologies (Mohammed-Amin, 2010). In providing the ability to move students out of the classroom and situate learning in different geographical contexts not only enables any location to be a classroom but also provides authentic learning opportunities (Perry et al, 2008). Sharples (2010) however, insists there is little understanding of contextualising learning outside the classroom or how technologies might support this while Wijers and Jonker (2010) suggest one of the biggest challenges is integrating the experience with formal learning contexts. While it is understood that mobile technologies do provide different contexts for learning Brown (2010) points out there is little understanding of the kinds of scenarios that are best supported by mobile learning, particularly for context-aware technologies such as augmented reality.

Brown et al (1989), are recognised as developing the concept of situated cognition which posits learning happens within the social, physical and cultural context in which it will be used and meaningful learning incorporates interaction with the people, places and objects within that given context. Lave and Wenger (1991) argue along similar lines, and many others since (see Herrington & Oliver, 2000; Herrington & Herrington, 2006) that learning should be in settings and situations that normally would involve that knowledge. For instance, language learning and particularly second language learning, is said to be best learned when it takes place within ordinary communication in a social and/or cultural context (Brown et al 1989). James Gee (2003) articulates a similar message in relation to situated learning through video games, whereby the player learns about game play and the role that they play, in a way that is embedded in the game context. Similarly, location-based AR has the capacity to facilitate learning by creating meaning 'in situ' (Squire & Klopfer, 2007) and is one of the key strengths of this technology that influenced choosing it to support the aims of this project. A location layered with a cultural story becomes the context for new understandings of culture through interaction between environment, person and artefact. The pedagogical focus for this project therefore, was guided by the concept of learning in context, in that listening to Nyungar stories in the context of their relevance, or the belonging place of the stories was more meaningful for students than by reading about or being told about a place story in their tutorial room. As such, this project has an alliance with other place-based education such as Gruenwald (2003) and Sobel (2004) and contributes to the writing in this field.

### **The Research Project**

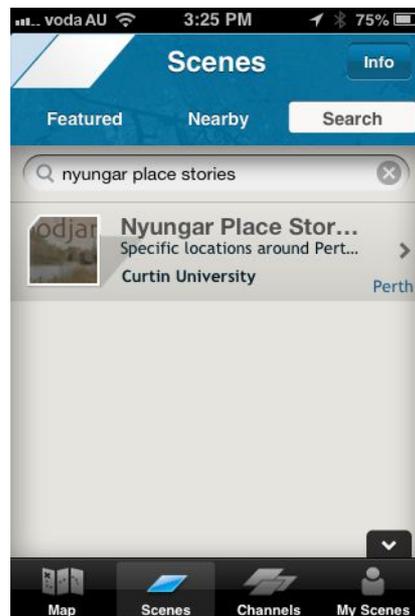
Nyungar Place Stories project uses location-based augmented reality to overlay physical sites with video and audio of Indigenous narratives that students could access through their mobile phone. Similar approaches have been used to explore historical or cultural heritage contexts (Mohammed-Amin, 2010) such as re-enactments of ancient Olympic games at original sites (Vlahakis et al, 2001), as museum guides (Damala et al, 2008) all of which extend the information about an artefact or place. Although Australian Indigenous cultural practice narratives and cultural connections to the landscape are explored through interactive 3D virtual environment (see Wyeld & Pumpa, 2007) this is not designed as a mobile experience. Using augmented reality in the context of connecting environment with cultural artefacts is relatively new as is using it as tool for teaching and learning in higher education.

### **Development of the augmented reality project as a learning tool**

This research project entailed developing the AR mobile app as a learning tool, conducting a pilot and reporting on the pilot outcomes. A commercial AR platform and web service was used to create a scene, which is a sequence of content (videos and audio) that have been uploaded to the web service and attached it to specific markers on a map. Students access the scene via the AR mobile app downloaded onto their smartphone.

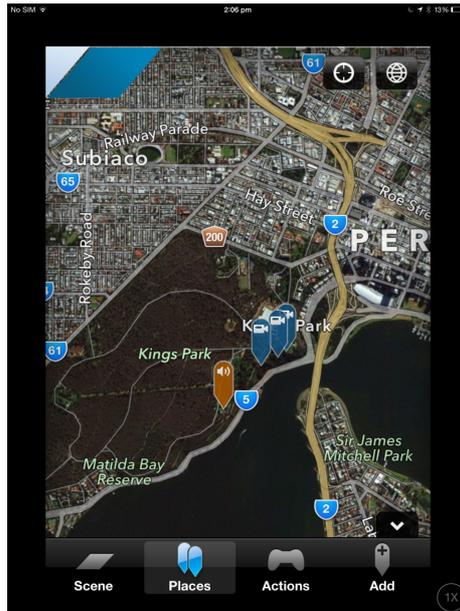
The project development adhered to appropriate ethical guidelines and cultural protocols (Curtin, n.d) for working with Aboriginal and Torres Strait Islander people. Specific sites in and around the Perth metropolitan area were chosen in consultation with Nyungar collaborators. A Nyungar elder chose the appropriateness of

stories for broader community consumption, and the narrative sites. A unifying criteria for the sites was that an Indigenous public artwork was located there, a significant story was associated with the place and the sites were easily accessed by public transport, car or on foot. The inclusion public art was ostensibly to create a unifying aspect but also served to provide additional traces of Aboriginal culture so that students might stay longer at the place and reflect. Nyungar elders and community members were recorded telling a story using video or audio at the specific site. These were uploaded into the augmented reality web service and pinned to the relevant site on a Google map of Perth that was embedded in the application. The application was published to allow users to access it via their mobile phone (seen fig. 1). Appropriate Nyungar community members verified the final product.

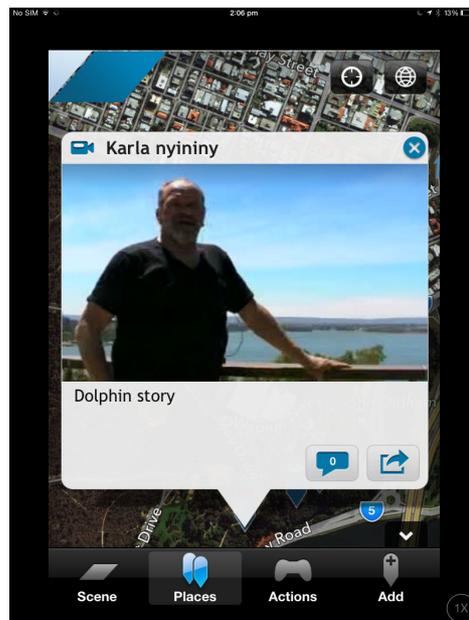


**Figure 1: Augmented reality app screen showing Nyungar Place Stories on mobile phone.**

Students downloaded the free app onto their mobile phone and accessed the Nyungar Place Stories scene. A welcome to country is on the first screen and the map button shows the story marker locations (see fig. 2). Students could also see their own position on the map that is shown as a red dot with concentric circles, which moves in relation to the student's location. When they could see their marker in close proximity to the story marker they were able to click on the story marker and the video or audio downloaded and played (see fig. 3). Instructions were contained inside the app and comprehensive instructions on how to access and use the app were provided in the Blackboards site. The project was not an essential component of the Indigenous Culture and Health unit but was developed to augment existing learning resources and was particularly relevant for the place and identity curriculum topic. Students were able to share their reflections with their peers during tutorials if they chose to and to record them in their personal journal.



**Figure 2: Screen grab of map showing markers on an iPad screen.**



**Figure 3: Screen grab of video with Nyungar elder Professor Len Collard telling the story of Karla nyininy (Dolphin story) from Kaarta Gar-up (Kings Park) with the river and city in the background.**

### **The Pilot**

The pilot ran for approximately one semester and while the Nyungar Place Stories app was not compulsory unit content it was promoted to students as a valuable resource that might assist with their reflective journal, which was an assessment item. A link to the app download page, along with information and a tutorial on downloading and using it was placed in the Indigenous Culture and Health 130 unit's Blackboard site. Progressive announcements through the Blackboard system were used over a number of weeks to encourage students to download the app and try it out.

The ICH 130 unit follows a blended learning format where materials online are accessed prior to a two-hour tutorial in a flipped classroom approach. As this unit is part of the Faculty of Health Sciences common core it's student enrolment is large, encompassing the entire first year cohort and requires approximately ten tutors to conduct tutorials. The app was demonstrated to tutors at a meeting prior to the start of semester and hand-outs

were provided demonstrating how to use the app and the content it covered. Tutors were not obliged to use the app or to ask students to use it but were strongly encouraged to do so. Both students and tutors were able to practice using the app with a specific channel that was created based on campus locations with the same features they would use for the Nyungar Place Stories. A demonstration for students on how to use the app was also available on request from the tutor however only one tutor took this offer up.

## Methodology and method

The research question guiding the study was “can augmented reality technologies facilitate Indigenous cultural understanding through place stories”. The intention of the research design was to capture a snapshot of student experience that had richness and depth rather than breadth. The methodology needed to accommodate the complexity of a student demographic from multiple cultural backgrounds, age groups and socio-economic status that acknowledged individuals interpreting their own understanding while providing a unified understanding of students as a whole. The overarching paradigm guiding this research was interpretive with an ontological belief that realities are multiple and constructed by the individual within their own personal frames and contexts (Crotty, 1998). A basic interpretive qualitative methodology which to some extent, drew upon the hermeneutic tradition of Gadamer (1975) and Heidegger (1962), guided the research process and data analysis.

Approximately two thousand students were enrolled in the Indigenous Culture and Health 130 unit at the time of the pilot. These were first year Health Science students and generally a mix of cultural backgrounds with a higher percentage of Australian born, white Anglo-Saxon heritage. The pilot was open to all students to participate by using the app and but only ten would be selected to participate in research interviews to provide a snapshot of student experience. An invitation to participate in the research study was posted on the unit’s Blackboard site. The announcement contained a plain language statement and a consent form that could be printed. A \$50 Student Guild card (good for coffee and student store goods) was offered as an encouragement to participate and compensate for interview time. Potential participants were asked to email the assistant researcher and the first ten to respond were to be accepted. Seven students responded to the invitation to participate and data were collected via semi-structured interviews that were electronically recorded with the participants’ permission.

## Findings and discussion

The key aim of the research project was to gain an understanding of how students make sense of their experiences of place narratives and how the AR learning tool may contribute to a deeper understanding of Aboriginal culture. The interpretive methodology informed by hermeneutics, was deemed appropriate for the research study because it allows for subjective interpretation that affords in-depth understanding. However after a broad-brush analysis of interview transcripts we found data were insufficient to provide the depth and richness of experience we had anticipated and a deeper more thorough analysis was not conducted. The issue was not with reduced number of participants but rather the level of engagement with the stories that lacked depth and richness of data. This brings forth an unexpected outcome but one that is equally worthy of reporting and an important finding for the pilot. It should be acknowledge that the role of a pilot study is identifying issues before rolling out the full research project. To this end the pilot was successful because it uncovered important issues that will be addressed in a second stage pilot.

The Nyungar Place Stories AR app was available to approximately 2000 students over 14 weeks. Analytics from the AR platform indicate only small numbers of students, roughly forty accessed the application by downloading it and travelling to one or more of the locations of augmented narratives. We made an assumption at the commencement of the pilot that:

- a. The tutors had received enough scaffolding and support for them to encourage the use of the app by students, and,
- b. A significant number of students would find the uniqueness for augmented reality to move learning into the landscape would be engaging enough to “have a go”.

The findings revealed that a comparatively small number of students were prepared to investigate the AR app. Indeed, as mentioned, only seven students responded to the invitation to participate in the research out of the anticipated ten. The majority of participants were International students. Four were from a country in the Asian region and one was from the United States, two were Australian. A preliminary interpretation could indicate there is more willingness on behalf International students to gain a better understanding of Indigenous culture by making an effort to go to specific places and engage with the stories however further research would be needed

to determine this. From the broad-brush analysis we found most participants engaged with the context of listening to the stories in the environment where they belonged however they wanted the app to be an essential part of the unit's study plan so there was a specific reason to go to a place to view and listen to a story. The AR app learning tool therefore should be valued as an essential part of the unit's content that could add richness to tutorial discussions and would be useful for students when writing their reflective journal.

An additional critical factor is that while the assumption that tutors had enough preparation and support this clearly was not the case. Although tutors were not required to include experiences of using the app and connected stories in their tutorial discussions the opportunity for them to do so was there. It was clear from the interviews with participants that tutors had not encouraged the use of the app and most had not mentioned it. As with all new learning interventions that introduce new pedagogies lecturers and tutors need to be aware of how they might use them in the classroom and therefore professional development to do so would be required. Herrington et al (2008) highlighted the need for this kind of professional development with mobile technologies and it is evident this still applies some six years on.

The overriding outcome for the research is that an assumption cannot be made that introducing a new technology regardless of whether or not it is part of the curriculum will not be successful without a developed approach to 'operational readiness'. Deloitte (2012) state that recurring failure for technology projects to be successfully implemented is the lack of an operational readiness plan that incorporates all stakeholders and is not just a 'tick off list'. In the case of this project according to Deloitte, providing foundation training to build core competence in specific roles, providing 'mission-specific training that addresses the need to adapt to meet the intended operational context and to rehearse training was needed. This would mean that teaching staff is trained to use the app, to teach with it to encourage dialogue around the stories in class and encourage reflective practice by students, and to take some ownership for the app. It would also mean that students would be provided with training in using the app in a functional way but also how to respond in a reflective manner to the stories and to consider the context in order to gain more of an understanding.

Despite the inability for pilot to achieve the levels of engagement that were anticipated there are some encouraging insights into experiences that can be built upon by adopting a more thorough and planned approach to further roll outs of this project. For instance, participants were entranced by the cultural richness of the stories within the context of ordinarily daily life for Nyungar people that provided an insight into pre-colonial Indigenous culture. None of the participants had heard the stories previously through their schooling or through publications and were surprised the stories existed in relation to the city of Perth area. They were enthusiastic about the app as a learning tool, they learned new things about Aboriginal culture and found the experience meaningful and useful.

One particular story referred to a dingo as the guardian of the river in Nyungar dreamtime and is also represented as a huge red dingo painted on the side of an old flourmill, which is an iconic landmark in the coast suburb of North Fremantle. The red dingo is well known to Perth residents but the connection with Nyungar dreamtime is not widely known. One Australian participant expressed her surprise in hearing this story because despite growing up in the area she had not heard the story and was unaware there was an Indigenous cultural connection to the popular red dingo icon. Another expressed amazement at trying visualizing a kangaroo hunt story she was listening to on the doorstep of the city centre. These provide a very small snapshot of the possibility for a transformative affordance for the use of AR technologies

## **Limitations and delimitations of the study**

The pilot was limited in the development phase to three locations that were marked with stories to ensure the development was manageable within the allocated budget and to gauge the level of success before outlaying more funds on content. An additional reason for limiting the locations was because the AR platform was a commercial product where registration fees limit continued access and ongoing funds could not be guaranteed. This proved to be a limitation to success in some respects as participants indicated they would have preferred more stories to choose from. The pilot implementation was confined to the one first year health science unit with the prospect of broader university implementation.

## **Future direction**

The next step will be to run an additional pilot with a set number of students and a well-planned operation to go live process as advised by Deloitte (2012). Additionally, in order for Nyungar people to retain authority and control of their cultural artefacts, future development of the project would require Curtin University to house the

content (stories) on their servers or in their cloud in partnership with the Nyungar community. Alternatives to a fully commercial AR platform and web service that would provide greater security of cultural content include free AR apps with purchased software development kits (SDK) that can be customized and integrated with a database via an open source API.

While the pedagogical approach moved the learning from the classroom to the landscape and embraced a more situated learning experience this could have been improved by being more interactive. In its true sense, situated learning should be activity driven. An important consideration for future developments is for the app to be more interactive so that students are doing something as well as receiving something (listening to a story). Therefore the app needs to incorporate some form of activity or interactivity at the location of the story. For instance after listening to the story at a given location the student could record their reflection and for example, upload to an online space or contribute to the story location on the app. Furthermore, using the app to access stories in context should be an essential resource in the unit lesson plan for tutorial discussion. On a final note, further research could frame this project within a critical pedagogy of place.

## Conclusion

In this paper we have discussed the development and pilot implementation of a project that utilises augmented reality to support the cultural sustainability of Aboriginal Nyungar peoples of Western Australia. The background to the study provides and understanding of how relationship with the land is imperative to the health and well-being of present and future generations of Australian Aboriginal people. The project was designed as a resource for the Indigenous Culture and Health unit to help non-Aboriginal students understand the value of cultural sustainability. This was a pilot study, and of equal importance to addressing the research question, is understanding how to implement this kind of learning tool and to explore this modality for contextualized learning.

We found our initial oversights and assumptions impeded a successful implementation of the pilot. While the study enabled the research question to be answered to some extent, data were insufficient to answer the question in the depth that was anticipated and was required for the methodology, and only broad outcomes were achieved. An unexpected challenge was the lack of engagement from both tutors and students, which ultimately signified that an “operation to go live” (Deloitte, 2012) process should have been adopted for this project to meet the anticipated outcomes and should be the prime consideration for future implementation and expansion. Future directions in our research will address these issues and make the learning experience more interactive.

Despite growing awareness of affordances for location-based augmented reality to support contextualized and situated learning in the K-12 education sector there is little evidence in higher education, thus provides fertile ground for further research in this area. Given the higher level of engagement from International students, future research could also examine how these technologies can be leveraged for cultural tourism.

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