Gamifying adult literacy learning with apps:
Reflections on the 'state-of-the-art' to the 'state-of-the-actual'

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Abstract

The purpose of this paper and session is fourfold. Firstly, we outline an enduring educational and social problem, poor levels of literacy amongst some adults, including students in higher education, and a potential innovative solution – the gamification of literacy learning. The problem of literacy development in higher education is often subsumed under study skills programs; however, we suggest that serious computer games can be used as digital tools to assist students overcome the shame associated with poor literacy and provide an engaging way to learn. Secondly, we outline the development of two serious literacy game apps, and discuss findings from an initial evaluation of one of the apps, Apostrophe Power. Thirdly, we offer some critical observation about game development and educational technology. Finally, we provide a series of questions formulated to facilitate a critical sharing of experience around individual and institutional use of educational technology.

Introduction

The rapid development and deployment of digital educational technology has prompted both 'blue sky' dreaming about its potential to promote tailored, engaging and effective learning in formal and informal educational settings, and critical reflections on the actual 'messiness' of its use in schools and higher education (Selwyn, 2010). This paper explores both positions by presenting a case study on the development of two literacy games, designed for university students. We outline an enduring educational and social problem, lower levels of literacy amongst some university students and a potential solution – the gamification of literacy learning. We then describe the development of two 'serious games' designed to improve adult literacy, results from an initial evaluation and some critical observation about game development, and educational technology, more generally. We then pose some questions to facilitate the sharing of experiences around the use of educational technology.

Background

Literacy is defined as "as understanding, evaluating, using and engaging with written texts to participate in society, to achieve one's goals, and to develop one's knowledge and potential" (OECD, 2013, p. 59). There is significant international concern about the levels of literacy in developed countries (OECD, 2013). For example, the Australian Bureau of Statistics (2013) reported that approximately 7 million Australians, or 44% of those 15-74 years, are below the minimum level needed to fully function in life and work. The literacy levels of university students vary with research indicating that poorer literacy has a significant impact on

retention and success in study, and beyond (Moon, 2014; Wingate, 2014). Low literacy levels can result in feelings of shame and stigma and a reluctance to seek help (Nicholas, Fletcher and Davis, 2012).

One solution is to tap into existing digital technology to engage adult learners to self-improve literacy in fun and effective ways. The advent and rapid uptake of mobile devices such as smart phones and computer tablets provides an opportunity for students to learn anywhere and at any-time (Martin and Ertzberger, 2013). Mobile learning (referred to as m-learning) can be used to supplement more traditional modes of instruction. The advent of apps has strengthened the serious games movement, a trend in educational technology which seeks to harness the enormous popularity of computer games for educative or training purposes (Connolly et al., 2012). The serious games movement has seized on this opportunity for educators and instructional and software designers to collaborate in the creation of learning games that incorporate the characteristics of leisure games such as fun, flexibility, competition (including self-competition) and goal mastery (Charsky, 2010).

The literacy apps

Drawing on these opportunities, an interdisciplinary team at the University of Newcastle (UoN), Australia, developed two serious literacy games for free download on iOS/Apple and Android devices. App development was underpinned by a commitment to equity: That is, all people regardless of socioeconomic background should have access to free, effective and fun learning tools. The first app developed was *Apostrophe Power*, a game designed for students to learn about and practice the correct use of apostrophes (contractions, ownership, and exceptional cases to the usage rules we termed misfits) [App developed 2015). The second game developed, *Sentence Hero*, focused on learning about and practicing the correct use full stops, commas, colons, semi-colons (as ways to fix run-on sentences), and the function of the subject and verbs in a sentence (as ways to fix sentence fragments) [App developed 2015-16. The games are available for free download:

Apostrophe Power	iTunes App store (iOS): https://itunes.apple.com/au/app/id1019114263
	Google play (Android): https://play.google.com/store/apps/details?id=com.reptiliaware.apostrophepower
Sentence Hero	iTunes App store (iOS): https://itunes.apple.com/us/app/sentence-hero/id1067198100
	Google play (Android): https://play.google.com/store/apps/details?id=au.edu.newcastle.sentencehero

In *Apostrophe Power,* the learner must drag the apostrophe into the correct position in a sentence under a time constraint − this being before the mouse avatar drops into the water as the island it is standing on slowly sinks (see Figure 1). The goal is to place the apostrophe correctly in sentences so that the mouse leaps from island to island until it reaches the cheese at the end of the level. The goal of *Sentence Hero* is similar. The learner must correctly place the punctuation or word in the sentence within a time constraint, with a self-selected avatar jumping over obstacles the size of which is determined by how quickly the learner undertakes the task (see Figure 2). Both games are designed with 'unlockable' levels of difficulty built in for each punctuation or grammar function.

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Figure 1. Screenshot Apostrophe Power

Figure 2. Screenshot Sentence Hero

An initial evaluation of Apostrophe Power was undertaken in 2015 (Smith et al. 2015). The evaluation received Ethics Committee approval (approval number H-2015-0226) and was designed in two parts. For part 1, undergraduate students across disciplines at UoN were invited to participate in an online survey to measure their current apostrophe skill level. The survey consisted of demographics questions and a 30-item apostrophe quiz (the pre-test) covering three categories of apostrophe usage, i.e. ownership, contractions and misfits. There was no time limit on the survey. Students with scores of less than 70% in the apostrophe component of the survey were then invited to be involved in part 2 of the evaluation. Part 2 of the evaluation was a session in which participants played the *Apostrophe Power* game for 40 minutes, completed a second apostrophe survey (post-test), and participated in a focus group. Students were allowed free use of the app and could attempt game activities or watch tutorial videos in any order. The post-test consisted of a 30-item apostrophe quiz with 10 questions of equivalent difficulty on each function of apostrophe use included in the pre-test. Of the 288 students who completed part 1, 131 students had scores that made them eligible to participate in part 2 of the evaluation. Initially, the intention was to use the full 30-mark score as eligibility for part 2 (e.g. only invite students with a score less than 21/30). However, on review of the results from part 1, it was found that all the students scored highly on contractions questions. Therefore only the results from the ownership and misfits questions (a 14/20 threshold) were used to determine eligibility for part 2. Of the 131 students invited to participate in part 2, seventeen completed the app game session and post-test quiz. On average, participants who used the *Apostrophe Power* app improved their apostrophe usage across all test categories (as shown by the middle and right bars in each category graph in Fig. 3). Evaluation of the apps is ongoing.
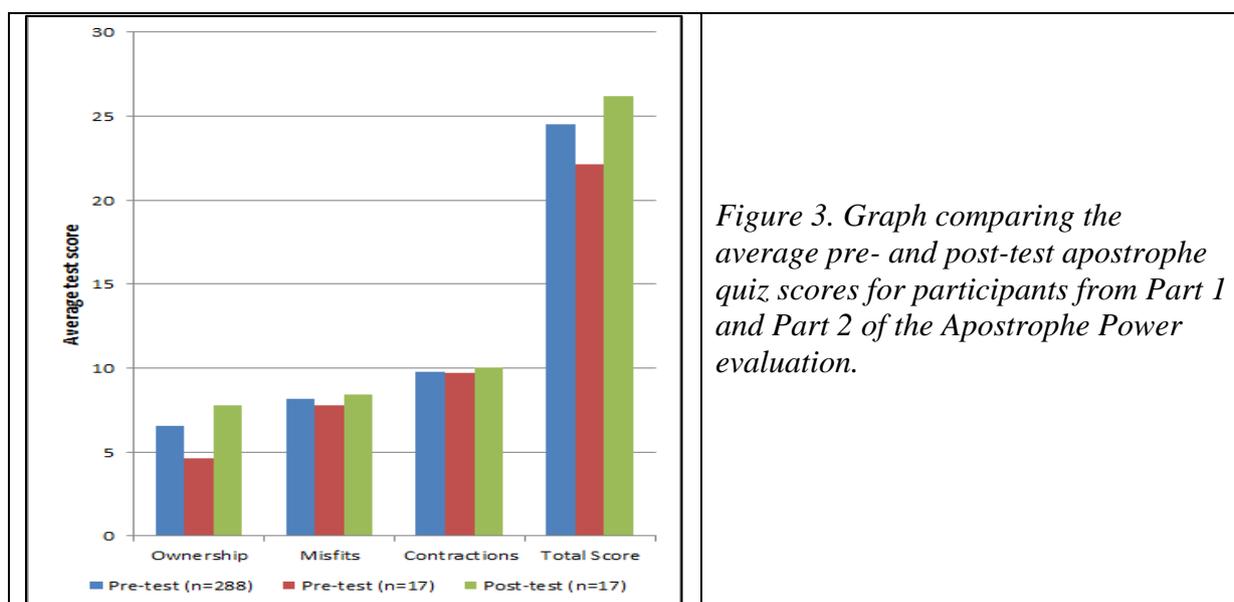

Figure 3. Graph comparing the average pre- and post-test apostrophe quiz scores for participants from Part 1 and Part 2 of the Apostrophe Power evaluation.

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Some critical observations on educational technology and serious game development

Selwyn (2010) suggests that the field of educational technology has a misguided focuses on the 'state-of-the-art' rather than the 'state-of-the-actual'. He suggests that a more critical study of educational technology is required, one that addresses questions about what is actually taking place when a digital technology meets educational settings. Such questions include: 'What is the use of technology in educational settings actually like?' and 'What are the consequences of what happens with technologies in educational settings?'(Selwyn, 2010, p.70). Using this critical lens, we pose the following observations on the development of serious games:

1. *It is hard to attract funding for serious games*: 'Selling' the idea of the gamification of literacy learning and its potential value in m-learning to funding bodies was difficult. We experienced many grant rejections over a number of years with feedback from reviewers indicating scepticism on the feasibility of educational games.
2. *It takes a long time to build and maintain a serious game*: Designing a serious game that incorporates robust learning and instructional theory takes time. The thought and experimentation required for each game was about 12 months. Fortunately, the 'shelf life' for literacy games is a long one. Maintaining the apps also extends beyond the life of funded projects i.e. with each update from Apple (iOS) or Google (Android).
3. *Interdisciplinary collaboration is required and this isn't always easy*: Iterating on ideas, practical and theoretical, particularly within interdisciplinary teams takes time. The forging of epistemic communities (Haas, 1993) is based on a mutual intellectual respect and the enactment of group dispositions: curiosity, openness, patience, diligence, and self-regulation.
4. *Evaluating game effectiveness can be difficult because it relies on student volunteers*: Even when robust evaluation is built into serious games development, finding enough student volunteers was challenging (even with recompense of a $30 voucher).
5. *Promoting the game is the hardest part*: It is not enough to release the game into 'the wild' of the app stores. A promotion plan that extends far beyond the normal academic dissemination routes is required, and this is not the strength of academics.
6. *People question why serious games should be free*: The idea of a free educational game is fairly novel to university administrators who suggest that in order to fund further research a cost should be assigned to downloading apps. There is a distinct tension between equity and the economic imperatives of institutions and building sustainable and innovative research programs.
7. *It is hard to find out how people use the game in 'the wild'*: Once the apps are released anyone, anywhere can download them. This is evident in our app stores analytics. These analytics inform us of how many apps are downloaded by country but not who is downloading and how they are using the games to learn.

Guide to session and interactive discussion

1. Brief outline of the project, its background and questions it raises, including relevant literature: 10 mins
2. Questions and discussion: 20 mins
Questions to stimulate large or small group discussion (depending on numbers):
   a. What interest and experiences do you have in educational technology?
   b. What might be some of the key issues in the 'state-of-the-actual' in educational technology in your institution?

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c. Do you personally use educational games or m-learning tools and/or with your students? What do you see as opportunities and drawbacks?
d. What feedback or suggestions do you have on this project?
e. What do you think are the 'take home' messages for you as an educator/practitioner?

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