Evaluating Apps for Learning and Teaching

http://dx.doi.org/10.3991/ijet.v7i1.1901

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Abstract—A growing number of educators and students are adopting mobile devices and using applications (apps). There are often no formal guidelines to assist with evaluating apps. A review of the literature was conducted to determine relevant criteria that could be applied to evaluating apps. Relevant examples are included where appropriate. Evaluation criteria are offered to assist educators and students with determining the suitability of apps.

***Index Terms*—Educational technology, mobile learning, applications, evaluation of technology.**

I. INTRODUCTION

Globally, the use of Internet enabled mobile devices is increasing. Rick [1], reports that between 2009 and 2010 in the USA there was an increase of smartphone ownership of 60%. Traxler [2] believes that the rapid uptake in mobile phones alone, has had an impact on communication and culture around the world. Budiu and Nielsen [3] suggest that for iPhone users, people prefer using mobile Applications (apps) to the web. Mobile apps often allow off-line access to content and have been designed for a smaller screen.

Many educators and students use mobile devices for social, work, or educational purposes. Apps are available for many purposes and can generally be classified into one of twenty categories (e.g. education, books, medical, healthcare and fitness, productivity, reference and utilities). Apps can be mobile textbooks (often with search capabilities), online journal and information searches, social networking, data entry for research projects, for entering work schedules and rostering or specific to a discipline. A number of recent student surveys in the United States of America (USA) [4], the United Kingdom [5] [6] and Australia [7] show high and increasing levels of ownership of mobile devices (Table 1).

Further, within UWA two surveys 2011 [8] (2010) [9] conducted in the Faculty of Medicine, Dentistry and Health Sciences (FMDHSc) found that 79% (62%) own a handheld device with Internet access (iPhone, Blackberry, PDA, iPod touch, iPad, etc). Eighty eight percent (82%) of FMDHSc students said they accessed the Internet from their handhold devices [9].

Mobile devices for learning have already been provided to students at some universities, for example medical education in the U.S.A. at Stanford University [10] and science education in Australia at the University of Adelaide [11].

With the increasing use of mobile devices there is an exponential increase in the number of apps available (e.g. via iphones, ipods, ipads, tablets, android devices) for educators and students. iTunes has a proliferation of apps available with 454,966 in total, 385,969 if you exclude games.

TABLE I.
STUDENT'S OWNERSHIP OF MOBILE DEVICES

Year	University	Finding
2011	The University of Western Australia (UWA)	76% 1st year undergraduates have a mobile Internet device (up from 42% in 2008)
2010	Edinburgh University (UK)	49% students had a smart phone
2010	University of Kent (UK)	78% of undergraduate students owned an Internet enabled phone
2010	Educause Centre for Applied Research (ECAR) (U.S.A.)	63% of college and university students own Internet enabled mobile devices. 11% planning to purchase one in the next 12 months.

Each app user will evaluate the usefulness of their apps according to their own needs. However, a question that comes to mind is "how do students and educators evaluate whether an app is an appropriate tool or not in their own context?"

Ellaway [12], a medical educator, suggests that apps lack a structural mechanism to assure quality and provenance. She also says that medical students and interns are experimenting with apps without support or guidance from teachers or institutions about the clinical content. After all, medical apps could be life-saving or lethal.

Ten criteria are provided, illustrated with examples, to assist with this process.

II. EVALUATION CRITERIA

A. *Consider the credibility of the app developers*

Credibility is probably the most important criteria for apps. Credibility matters more for some apps than for others. For example, productivity apps just need to work and be reliable and the author's affiliation isn't as important as for discipline specific apps. A discipline example is medical practice, where a medical app that gives incorrect drug information or calculations could be disastrous for patients. Teaching and learning apps that have been developed by experts or in partnership with a college or university are more credible than those developed by individuals.

Six questions, adapted from Trinkle and Merriman's 2006 criteria [13] for evaluating web resources are presented to assist with evaluating the credibility of the app's content:

- Who are the authors? Accredited bodies are more credible than individuals.
- Are there any reviews of the app, if so who are the reviewers?

- Are the author/reviewer credentials listed and verifiable?
- Does the author/reviewer document experience and expertise on the subject presented?
- Does the resource put forward a particular organisation's view?
- Who has sponsored the resource, or is there a conflict of interest statement? There may be competing interests.

If we review the Statistics1 app [14] using the above criteria, the authors credentials are listed: they are a private company. However, the executive is made up of many educational experts with PhDs from various relevant disciplines. Another indicator may be their list of clients (e.g. Cambridge University). There may also be several reviews of the app on the iTunes or the Android Market sites.

B. Determine whether the app is relevant in your context

Is the app relevant in the local setting? Acceptance of the use of mobile devices differs depending on the context. For example Kajewski [15], a first year medical student at the University of New England felt uncomfortable with "pulling out an iPhone in front of a patient" [to use an app] but she is comfortable using apps (e.g. Netter's Anatomy) for her learning away from patients. The local setting will determine the suitability of using apps.

Many of the available apps have been developed for the U.S.A. market and may not be relevant in other countries. For example, one of the most useful apps for medical students to refer to for drug information is Epocrates. However, the trade names of drugs may be different outside the U.S.A. Similarly, the Australian drug therapy app, MIMS, is an example of a credible, up to date app but the trade names, pricing and dosage information may not be relevant outside Australia.

The dates of creation and last review also need to be checked [13]. These can normally be found by checking the relevant app provider's web site (e.g. in iTunes this can be found under the Category information).

C. Is the written and visual content aimed at the appropriate level?

Is the content appropriate for the prospective user: educators or students or professionals? Does the app do what it claims to do? Are the images clear?

With each user type, there will be different levels of comfort with using technology. In particular, some users will be more tech savvy than others and this also has to be considered when recommending apps [16]. Examples of apps specific to each type of user are:

Educators can use specialised apps for teaching to present content, video and photos, to save PDFs or as an audience response system. For example:

- eClicker: an app than can be used by teachers for student polling. Students can vote via their mobile device or on a computer [17]. Teachers need to purchase and download the teaching app eClicker Host to create polls/quizzes and to be able to present the results back to the students.
- TED talks: a free app that allows users to watch or download individual Ted Talks videos with subtitles (themes are varied and include innovations, educational, technological), including the ability to view later without WiFi. TED talks is a private not for profit organisation devoted to ideas worth spreading, it provides a platform for innovative ideas to be spread through events, presentations and media [18].

Students are using apps in many ways - organisational purposes, database searching and for collaborative and/or individual work.

- iAnnotate PDF app for iPad: this app allows students to make annotations to PDFs and email or download [19]. This is currently being used by students at Stanford University.
- Statistics 1 app: this app includes Lessons, Sims and Tools, Quizzes, a Glossary, Formulas, and Flashcards about statistics [14]. The app was developed in conjunction with the Abilene Christian University in U.S.A.

D. Is there an advantage to using an app over a web-based equivalent?

Compare the web-based resource with the app, is there an advantage to using the app [20, 21]. For example, does the app allow off line access to the content?

Apps that are based on content from other formats are common. Book and journal content is increasingly available online as mobile versions (e.g. music students can use Naxos Music Library (NML) [22] and medical students can use Mobile Clin-eguide [23]. Some apps are based on the traditional model of publishing and therefore may have the same credibility as the print equivalent (e.g. Nature.com is authored by the same publishing group who publish Nature [24]. The NML is an example, where both a web resource [25] and an app [22] are available.

E. Consider the design and usability of the app

Is the app easy to use? Is the interface intuitive? Is the navigation obvious or hidden? Is the text readable without zooming in to read it? Does the app have additional functionality/interactivity- e.g. searching? For example, for Science students the Muscle System Pro app [26] includes interactive quizzing where users can zoom in to identify specific muscles. After three failed attempts the app can show you the answer.

F. How does the app perform?

Is the app error free and does it load consistently? Loading time and file size are both important in determining performance[20]. It is also important to check that the mobile device has enough space for the app. Loading speed will be particularly important in some apps e.g. audience response systems. Apps that can be used offline, without requiring an Internet connection, are generally quicker to access if they are not dependent on Internet access. The file size of the app is normally listed on the download site. An example of an app that can take a long time to load is provided by Kajewski [15] who notes that Gray's Anatomy [27] is 402 megabytes.

The performance of some apps has been tested by the distributor (e.g. iTunes). Terry [5] states that Apple "do an outstanding job of testing applications to determine

whether each app functions correctly". He quotes Schwartz MD, a smartphone app developer "They will go to great lengths to make sure there are no bugs. They really do a great job of testing it. But I suspect they don't read the content". However apps that have been developed for Android devices are not be subjected to such testing prior to their release. Another place to check reliability of an app before you buy is app review sites.

G. How much does it cost and are the updates free?

The cost of apps vary from those that are freely available to those with a significant cost, although very few are prohibitively expensive. This is particularly important for students. There are a number of different pricing structures, the most common being:

- Free download and available to all.
- A free version and a paid version. The paid version will have additional features e.g. Epocrates has a free basic app including a drug interaction checker and medical calculators [28]. Additional features are available with payment including a medical dictionary and treatment guidelines.
- Priced. This can be minimal (e.g. A$1.19 for Medical Calculator) or significant (e.g. A$170 for MIMS)
- Free access for individuals if their institution subscribes. Individuals download the app to their own device but the download is free. DynaMed is an example of this pricing model. However, not all apps provide this option for educational institutions.
- Free or paid upgrades.

Recommendations of purchase of apps has implications for students [15]. There should be a clear advantage to teaching and learning outcomes through using the app. For example, some apps based on textbooks cost more than the textbooks themselves. The price of the MIMS app is likely to limit up take by students.

H. Consider whether the app providers keep the information private?

Make sure you read the privacy information provided by the app developer. Some information may be transmitted back to the provider without notification. A Wall Street Journal investigation found that smart phones may, in some cases without your knowledge send your device's unique ID, age, gender and/or location to external sites [29]. Thurm, Kane et al and Valentino-DeVries [30, 31] provide several tips about privacy measures for smart phone users. For example, if an app requests your permission to access or share certain information, such as your location, you can always refuse it, however, be aware that some apps may not function correctly without it.

I. Consider whether the app can be customised or is extendable

Does the app allow you to customise it? For example, can you take notes, save calculations or personalise it. Does the app have additional tools or features such as quizzes? An example medical education app is History and Physical that allows users to take notes, including patient histories, and stores the information.

J. Other considerations

Concede that you won't be able to keep up to date with every new app that is available [32]. As at October 2010, there were at least 300,000 apps available in the iTunes store (3104 medical apps as at 14 December 2010). One way to keep up to date is to monitor sources of free information. There are a number of review and social networking sites that will help keep you up to date [32]. As in the evaluation of the app itself, it is also advisable to ask whether the review is credible. Setting up RSS feeds from these review sites will push information about new apps to your mailbox. Other ways to keep up to date are to collaborate with others either face to face or virtually - talk to colleagues who are interested in keeping up to date with the latest apps in your subject areas and agree to share information or read summaries in journal articles, e.g. Rao's [16] survey of iPhone apps for self-monitoring of blood glucose results and Oehler's [4] article on infectious diseases resources for the iPhone.

Remember that it is also important to weed your apps on a regular basis to make sure they are still useful and current. Examples of review sites include:

The macworld web site includes reviews of 279,472 apps (as at 26 October 2011) for either ipod, ipad and iphone apps (http://www.macworld.com/appguide/index.html).

The imedicalapps site reviews apps specifically relevant to medicine and the reviewers are medical professionals. It includes a 'top 20' medical apps section. http://www.imedicalapps.com/

II. CONCLUSION

In conclusion, although criteria can assist with evaluating apps, educators and students would also benefit from actively collaborating and sharing their experiences about their use of Apps and how each App has enhanced or supported their teaching, learning or otherwise.

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Manuscript received 13 December 2011. Published as resubmitted by the authors 28 February 2012.