

# DETERMINING ACCESSIBILITY FOR iOS APPLICATIONS: A CHECKLIST FOR PRACTITIONERS

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## INTRODUCTION

### Mobile Technology

Mobile technologies are a class of devices including smart phones and tablets. The development of mobile technology created the fastest growing technology trend in history (Bansene, 2011). These devices now play a major role in every part of an individual's life including personal, professional and educational. Smart phones and tablets are so pervasive in part because of their customizability. Millions of applications (apps) are available across devices and interfaces that allow mobile technology to be as unique as the person using it. These apps allow users to run business transactions, check medical records and take classes all from a single device. Unfortunately, many of the applications that make new things possible are not accessible to individuals with disabilities. This paper describes the development of a checklist for mobile iOS apps to review their accessibility features. The purpose of the iOS Application Accessibility Checklist (iA2C) is to help practitioners who frequently need to help select mobile software determine which features are most important for a user with a disability in the context of an elementary school setting.

### Mobile Technology and Schools

According to Apple Inc., 10 million iPads are being utilized in schools worldwide. Four and a half million of those are in classrooms in the United States (Apple, 2013). However, not all students are able to access this vital resource. This is partially due to the fact that many students do not even have access to the devices that would make a mobile technology program functional (Fink, 2003). There is also a gap in the ability of individuals to utilize the technology that is available to them (Fink, 2003). This is due in part to user impairments which can make mobile technology difficult, if not impossible to use. In U.S. school systems, there are 6.4 million children who qualify for disability services (NCES, 2013). Under the Individuals with Disabilities Education Act and Free and Public Education, all of these identified children have the right to free and accessible education, which includes the use of technology integrated into the classroom experience (US

Dept. of Edu, 2010). Even as the pace of mobile technology integration into education continues to increase, many people's view on the needs of the disabled community fails to keep pace (Kouroupetroglou, 2012).

### Past Research

Technology is changing faster than universal design features can be implemented (Vanderheiden, 2008). This has resulted in there currently being no formalized research available looking at the accessibility of iOS applications. Much of the information available specifically about apps is provided directly from Apple. They have published features of their devices that all apps should be compatible with, and publish code for app developers to utilize to make their product accessible (2014). However, this has shown to lead to only minimal accessibility when used and there is no process to verify they were used prior to an app being published (Baumann, 2014). Some of the individual apps provide information regarding their accessibility or design for people with a specific disability. Unfortunately, these are often apps only intended for that population, not everyone.

With over 1.2 million apps in the iTunes App Store it can be overwhelming for consumers to figure out whether an app is accessible to them. Blogs, comments and review are available from individual users with disabilities. However, these are often specialized to an individual impairment and application of interest to the person publishing the information. Due to the nature of the information, it is difficult to know how reliable it is.

### Website Accessibility as a Foundation

Since no standardized mobile app accessibility evaluations are widely available in the literature, other accessibility measures and assessments are informative. The most relevant of these measures include the accessibility guidelines for websites. Many important accessibility features are addressed in the usability guidelines created by W3C Web Accessibility Initiative (2008).

Accessibility Measures for in the Classroom

Additionally, a number of accessibility measures were created as part of the ACCESS-ed project, which serves to provide solutions to the difficulties that arise when attempting to create inclusive classes (ACCESS-ed, 2011). The Accessibility and Universal Design Information Tools (AUDITs) are one of the many ways the ACCESS-ed program attempts to meet this goal. Each of these measures look at the specific accessibility and general usability of a target function in education, such as a slide set presentation, syllabus or lecture presentation. The accessibility sections are used to identify any serious barriers to people with disabilities. The usability sections are intended to determine the ability of the item to be adapted to the users' needs. This approach served as the basis for the (iA2C).

Development of the iOS App Accessibility Checklist (iA2C)

The iA2C was created to provide educators, therapists, specialists and parents another tool to create a more inclusive school environment for children with disabilities. It was also designed to address the lack of easy to understand application accessibility resources currently available (Baumann, 2014). The iA2C is based on an extensive literature review of accessibility features for websites and mobile technologies. Many of the questions are based on concepts addressed by the W3C Web Accessibility Guidelines because some apps are altered versions of existing web content. As a result many of the important accessibility features are valid across interfaces. W3C guidelines require content to be operable, perceivable, understandable and robust. This indicates that content is easy to maneuver, comes across in a predictable manor and is easy to read among other things (2008).

Many questions address the accessibility features that are innate to the iOS devices. Examples of these can be seen in Figure 1.

						Y	S	N	NA
<b>Accessibility Section 1 - Vision</b>									
1	Does the app have audio output?								
2	Is the app compatible with VoiceOver?								
3	Is the app compatible with Speak Selection?								
	Is all relevent non-text content also available in text form?								
<b>Accessibility Section 2 - Hearing</b>									
1	Are in app videos enabled with closed captioning?								
2	Is the app compatible with Mono Audio?								
3	Are all app notifications visual, tactile and auditory?								
<b>Accessibility Section 3 - Motor</b>									
1	Is the app compatible with assistive touch?								
2	Is the app compatible with Switch Controls?								

Figure 1. Selected questions from the iA2C.

The iA2C was organized in much the same way as an AUDIT. Questions are divided into sections based on impairment category. The categories are as follows: visual impairments, hearing impairments, motor impairments and cognitive impairments. Questions can be answered as yes, no, sometimes or not applicable if it is irrelevant to a given app. Upon completion the iA2C is scored automatically and results can be easily interpreted.

A manual has also been created to guide even novice technology users through the iA2C. Step by step instructions guide the user through the entire assessment process and explain how to navigate features within the iOS device. Many of the features the iA2C and manual address can be accessed through the Accessibility tab, within the Settings screen on the device. This is depicted in Figure 2.



Figure 2. Activating accessibility settings in iOS

The iA2C is intended to guide the users focus when considering the important features of an app. As a result, it can be a static checklist that does not modify the questions based on previous answers (Winters, 2009). A checklist was chosen to convey this accessibility information because it is a common cognitive tool that can be used to guide more complex tasks (Winters, 2009). It is

also an easy way to reduce errors when performing cognitively demanding tasks (Hales, 2006 & Oxman, 1994). This is achieved by presenting information in a clear and systematic way (Oxman, 1994). This is only effective if information in the checklist is clearly explained and defined.

Pilot Validation

The overall goal is for practitioners with little to no experiences in accessible design (novices) using the iOS Application Accessibility Checklist should be able to identify an equivalent number of accessibility features present in an application to that of an expert in accessible design who also has access to the iA2C. A novice without access to the checklist will identify significantly fewer necessary features than the experts. Novices without access to the iA2C will also identify significantly fewer necessary features than novices with access to the checklist.

In this context and knowing that the iA2C had no validity research we have staged a sequence of validation studies. The first early study performed a phase one examination of the effectiveness of the iA2C as a tool for assessing which features are important for the accessibility of an application for a user with a disability.

For this three participants were recruited. They had a variety of experience with accessible design and iOS devices. One had extensive experience with iOS devices and accessibility and universal design. One had experience with universal design, but not with regards to iOS and the final participant had no previous experience with either.

All three participants were asked to use the iA2C and the accompanying manual to assess an educational app, an entertainment app and an app that could be used for classroom support. Figure 3 shows the number of features, out of 30 possible, that participants identified as completely absent from the applications. It is important to address the absent features because these are what limit the usability of the app.

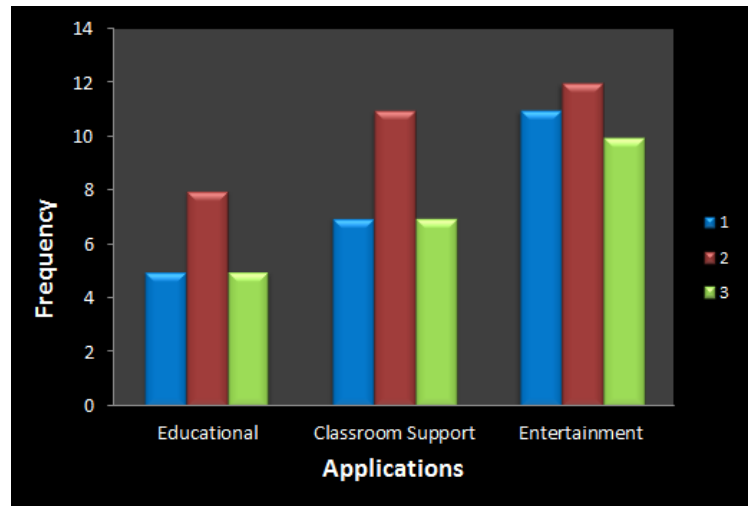


Figure 3. Number of accessibility features identified as absent from selected applications.

**DISCUSSION**

The phase one examination indicates that users with a variety of experience regarding accessibility and iOS can use the iA2C to assess an app and come to very similar conclusions regarding its accessibility. A follow up discussion among participants determined that variations were due in part to participant 2 only assessing a small the main screen of the apps rather than the entirety of the app. The task instructions have been modified to eliminate this problem in the future. The features that are missing limit the accessibility of the apps to a variety of users. By creating a means to accurately assess the accessibility of an app the iA2C can be used by a variety of professionals to determine what technology should be utilized in a classroom environment.

Future research and design plans include conducting a 2x2 mixed factorial design using experts and novices in the field of accessible design to assess two pools of applications. For the first part of the study both the experts and novices will be asked to assess three applications without the use of the iA2C. They will be asked to make a list of features that make each app accessible and a list of what features may be missing that make the app inaccessible. They will then be asked to return and perform the same task with a second, matched pool of apps. However, this time they will be given access to the iA3C and accompanying manual to guide their responses. They can once again list features or just complete the iA3C.

Listed responses will then be coded and scored by blinded third party coders. They will collaborate to code responses and determine which question on the checklist if

any they address. Apps within in each pool will be randomized amongst themselves prior to being provided to the participants in order to avoid order effects. These apps will fall into the same categories as those used for the preliminary validation: educational, entertainment and classroom support. It is believed that use of the iA2C will once again lead to equivalent responses between novices and experts with regards to the missing features, which make the app inaccessible.

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