

# Chapter 2

## Introduction to Tablets and Their Capabilities

**Abstract** In this chapter we provide a few introductory notes on using and optimising tablets for fieldwork learning. Tablets come with few instructions, however some users are not used to exploring the operating system or realise that you can achieve a result in a number of different ways. Supporting documents are available e.g. for iPads at Apple (2014) as well as number of basic guides, see Turner (2014). While this chapter is not a ‘how to’ manual it seems appropriate to provide some extended notes relating to the fieldwork functionality of tablets with regards for example, connectivity, accessibility and data storage.

**Keywords** Tablet computer · iPad · Field-ready · Functions · Internet connection

### 2.1 Usability of Tablets

The usability of tablets depends upon the size and, to some extent, price. Thus, although smartphones fulfil many of the capabilities in Table 1.2 they provide rather small screens, even at high resolution, and relatively poor battery life compared with the larger tablets. Battery life is continually improving but 10 hours use of a tablet should be achievable even with power intensive uses such as GPS location. We used iPad 2s from the start on our project but the smaller iPad mini has meant increased usability in the field because it fits into a pocket more easily.

Students generally described iPads as ‘easy’ and ‘useful’ when answering a usability questionnaire after a field session using iPads to support their learning. Figure 2.1 shows a ‘word cloud’ of a typical class response to the use of iPads after these two main responses have been removed.

When people ask about using tablets as notebooks in the field the question immediately raised is ‘what do you do when it rains?’ The cheapest solution is to use a polythene bag with a few grains of rice to absorb any moisture. It works; as does a waterproof housing for underwater use in extreme fieldwork such as marine archaeology or a shock-proof, waterproof case for general outdoor use (Fig. 2.2).





**Fig. 2.3** Word cloud formed from students responding to ‘disadvantages’ in a post field trip questionnaire on the use of iPads in the field

from the weather and from knocks but are inconvenient when access is needed to the charging port or camera/microphone connections. They also make the device much bulkier. For most purposes a simple case with a screen cover works well enough. For class use however, ruggedised covers are probably a worthwhile investment as students’ main concerns over the use of iPads in the field reflect worries over damaging expensive department-owned equipment (Fig. 2.3).

One word not used in our survey is ‘glare’ or ‘reflection’ or associated problems from direct bright sunlight. This may be a consequence of fieldwork carried out in the British Isles! Several types of proprietary anti-glare (and screen protector) kits are available. However, it has to be admitted that glare may be a problem and this is where a high contrast screen (such as on the Kindle e-book reader) performs well.



**Fig. 2.4** iPad Mini with BT keyboard acting as a rest. Below is the holding part of a case with the screen flap turned back and key ring holding an extending safety line. To the left is an Apple BT full size keyboard, BT earphones and microphone and the silver ‘drum’ is a desk-top BT loudspeaker

(Note that these high contrast screens are sometimes called ‘electronic paper’, ‘e-paper’ or ‘electronic ink’ screens but these terms cover several types of technology.) At present, this disadvantage with iPads needs to be weighed against their much more general usability compared with e-book readers.

Although much data entry, from writing to entering values on a spreadsheet, can be done via the screen keyboard this can become tedious and difficult for more than a small quantity or time. Some tablets come complete with external keyboards (such as the Microsoft ‘Surface’) others need them bought as extras. These will usually fit snugly but a full-size Bluetooth (BT) keyboard could be used in the office. Made to measure external keyboards are still a little cramped for use on an iPad Mini. Figure 2.4 shows relative sizes of some devices and Bluetooth keyboards. In practice you can use a conventional keyboard at home for protracted typing and the small device in the field for notes.

## 2.2 Getting Used to a Device

We suggest that tutors, as much as students, become familiar with their devices before using them in the field. Although our students are supposed to be ‘digital natives’ this ability may only go as far as using social media and taking photographs/videos and emailing them. Students should be given opportunities to become familiar with the new technology and be made aware of the means of saving and storing attachments, and we devote some attention to this below. They should also be aware how to use screen gestures, keyboard shortcuts, ‘undoing’, closing down apps in multi-tasking and basic aspects such as rebooting and taking a screen-shot. To assist with familiarisation there are various on-line guides and help forums as well as guidebooks available on the market.

It will not take long but a little time spent getting used to a device will, or should, ensure more efficient time spent in the field. It is important to check that the equipment has the appropriate apps loaded and is fully charged before going into the field! This is also a good time to think about students with any known disabilities. There are now many apps (and some hardware devices) that will enable disabled students to perform better and not be seen to require special attention. In any case, we suggest that all students are clear on the use of devices and apps before they go into the field. We have several examples of pre-field trip experience in Chap. 7 and these could be used to get students accommodated to the devices and apps to be used in the field.

At the least, we suggest that students (and tutors!) know how to do the following:

- ‘undo’ instructions from the keyboard
- know how to use keyboard shortcuts for typing
- how to take a screenshot and access it

- monitor battery and memory storage space use
- share/export/send/open files in another app and use *AirDrop*

## 2.3 Communication

Tablets, like smartphones, are essentially communication devices. Smartphones, like any telephone, tend to be thought of in a traditional manner. Talking, or texting, to another person is this basic. However, Table 1.2 extends the ways that we can use tablets to communicate with students. It tries to provide a basic rationale for using tablets and apps as an enabling technology that is only just now possible. Chapter 6 offers detailed case studies of how communication can be facilitated between staff and students.

## 2.4 Accessibility

Both Apple and Windows operating systems have gone to great lengths over the years to improve ‘accessibility’. That is, allow for people who may be disabled in one way or another or have special needs. In the UK, JISC’s TechDis (2014) is an advisory service for inclusion and highlights ways in which computer technology can be used to help accessibility and inclusivity in Higher Education.

One major function of tablets is the ability of tablets to be used to improve accessibility and this often means using the tablet to transfer information from one ‘sense’ to another, voice recognition for note-taking is one such. The ability of tablets to combine data input and move it between senses (Table 1.2) is one where the inventiveness of app designers has had considerable input to education and where fieldwork, in all its manifestations, benefits. For example, cold fingers often make traditional note-taking with pencil and notebook difficult. A tablet’s screen keyboard alleviates this problem but a voice note taker may be the answer. Anything other than a tablet or smartphone means a larger cumbersome laptop is necessary and a dedicated voice record one more device to juggle with.

Apple’s *Siri*, provides a measure of on board task management by voice recognition that may be useful. This capability will undoubtedly increase as computing power and sophisticated algorithms improve. If keyboard entry is needed then some apps will make the process easier; one such is ‘*Fleksy*’. In general, tablet manufacturers have developed ways of accommodating to users’ needs. The use of keyboard short-cuts is one of these, although perhaps the most significant is the use of gestures. Note however, that it is not possible to use a Bluetooth mouse or trackpad with iPads. However, a capacitive stylus or pointer is useful, especially for drawing and annotating applications.

## 2.5 Connectivity

It is not always necessary to have any Wi-Fi connection in the field or even 3/4G mobile Internet coverage. Indeed, in some locations fieldwork may be taking place well beyond their reach. Most apps will work on the tablet and do not rely on computation being done interactively on a website. iPods and other similar devices act as useful, less expensive devices than tablets but lack some functionality as not all apps will work on them. We suspect that these will go out of fashion as tablets with full interconnectivity (i.e. with 3/4G) become cheaper. Kindles and other e-book reader devices can certainly act as field devices but in a limited way. The usability of tablets like the iPad and Galaxy are preferable for field, and general educational, use.

An important distinction between the Wi-Fi only and the Wi-Fi+3G iPad is their ability to receive Global Positioning System (GPS) signals. The Wi-Fi + 3G iPad and the iPhone both have a GPS receiver. The Wi-Fi-only iPad and the iPod do not; these devices require an accessory to receive these signals. GPS signals come directly from the network of GPS satellites and provide latitude and longitude information. This function is of great use in fieldwork as devices with internal GPS receivers can log location information in remote places without Wi-Fi or 3G connections. However, the digital compass and accelerometers are in both WiFi and 3/4G varieties and also the latest iPad Air version. In choosing an iPad therefore, not only are physical size and connectivity important factors to consider but also processor speed and memory available. It is wise to do a model comparison, especially for recommending any bulk purchases for an institution.

## 2.6 Digital Mapping

Maps provide the basis for many aspects of fieldwork. *GoogleMaps* and *GoogleEarth* are perhaps the best known free base map possibilities. For national surveys, whether of topographic, road or Lidar imagery as well as satellite data, price structures may vary according to current situations. In the UK, Edina (2014) delivers a variety of services including Digimap (which allows free access to maps for subscribing UK universities and colleges). In the USA, the USGS and NASA provide similar facilities. Although an eye needs to be kept on reproduction and intellectual property rights (IPR), it is possible to facilitate field mapping by capturing an image via the iPad camera and importing it into an app such as *Sketch*, where it can be annotated (and see more about this app in Chap. 3). Further information concerning geo-referencing/geotagging photographs is provided in Chap. 4, Sect. 4.5 and in Case Study 8. Specialised fieldwork apps that have digital mapping functionality are considered in Chap. 8.

## 2.7 Data Storage

With ‘the Cloud’, becoming increasingly present in populated areas backup and data transfer is now relatively easy to set up. Tablet manufacturers have their own systems; Apple (*iCloud*), Android (*Google Drive*) and Microsoft (*SkyDrive*) devices also have a pick of several sites to which backups can be made and files shared between users. See Sect. 2.8 on the use of *Dropbox* as a generic system for data storage.

There are other ‘cloud’ storage systems available such as *SugarSync*, *Copy* and *Zipcloud*. A web search will show what is currently available as well as their costs and storage capacities.

There are also flash memory devices that can act as local Wi-Fi-storage. Such devices (such as Transcend’s *StoreJet* and the *AirStash*) allow you to provide access to several tablet devices and save memory by carrying video and music off the tablet. These are useful for data sharing and backup if cloud storage is not available.

As well as normal storage ‘on board’ storage there are of course image-dedicated storage and display systems of which *Facebook* and *Picassa* are the best known. Storage limits are variable and for heavy usage it may be better to subscribe to a cloud-based storage site. There are also social networking apps to share images and video. *Instagram* is one such and *YouTube* and *iTunes U* are widely used in an educational context. As professional photographers now use iPads on shoots there are now cloud-based image storage apps available for such ‘high end’ use. Although there are cost and size limitations of these facilities we leave it to the user to choose what seems best for their purposes.

## 2.8 Data Sharing

It may well be that students have to share a device in a small group, not only because of cost but because group work is common in the field. Students might need to share information with staff or other groups. Some apps, such as *Bump*, avoid the use of iTunes, others (e.g. *AirForShare*) allow file sharing between different OS devices. The lack of a USB ‘stick’ might seem a disadvantage but there are several apps that can be used to share information locally. *Airstash*, as just mentioned, is one such storage device with Wi-Fi.

***Dropbox*** is a free piece of software that can be used on a desktop/laptop, Smartphone or on a tablet computer such as an iPad or a Samsung Galaxy Nexus. Dropbox folders can be shared across class groups, offering an alternative to the VLE during fieldwork. *Dropbox* is a cloud storage system and syncs automatically, which means any changes made to a document on a

desktop computer are automatically updated on the tablet or Smartphone version (and vice versa).

One of the main benefits of *Dropbox* is that it is an easy way to upload documents from a Smartphone/tablet to the desktop version and does not require iTunes. Folders can be shared which is ideal for collaborative work in groups, which takes place on many field courses. Users have access to 2 GB of space for free; more space can be purchased if necessary. It is regularly cited as being a “must have” app for the iPad, which at present has no inbuilt file organisation/storage system. However, there are file management apps (such as *Documents5*) that can interact with *Dropbox*, *Google Drive* etc.

*Dropbox* is available for Windows, iOS, Kindle Fire, Blackberry and Android platforms. For further details see *Dropbox (2014)*.

Field data can be collected and shared using on tablets through *FieldtripGB*. This app created by EDINA at the University of Edinburgh can be used offline and uses *Dropbox* to upload and synchronise the data when in a Wi-Fi hotspot. A bespoke field data collection form can be created, prior to the fieldwork and subsequently presented on a base map or exported for further analysis. Other field trip notebooks are available and discussed in Chap. 4.

Showing images, results, and data to groups is often an important part of fieldwork sharing and feedback provision. With an iPad or iPhone you can do this in several ways. If there is a video projector with a VGA input (such as you would normally plug into a laptop) then a Apple ‘Lightning’ connector to VGA allows you to do this easily. Most projectors pick up the signal easily.

A local wireless network can be established between the iPad and the video projector with the aid of WPS2 Dongle. Apps such as *Wifi-doc* or *MobShow Lite* will display presentations, images and PDFs via Wireless Dongle to enable any mobile device to share the VGA projector. Alternatively you can use AppleTV to wirelessly connect you iPad. An easy way to hook up to most modern LCD/plasma screens with HDMI outputs is by using an HDMI-HDMI cable (being careful to note the sizes of terminal) and suitable connector to the iPad.

Providing amplified audio output from an iPod or even iPhone is easy with either small, unamplified speakers or, rather better, a Bluetooth-connected speaker (e.g. HMDX Jam Plus) with internal battery.

## 2.9 Data Processing

Although students tend to use a spreadsheet to process data back at University, this might not be the best way to proceed. Apps are now available (*Numbers*, *Excel*) for students to have the ability to collect data and process data in the field.

It may be however that a ‘standard’ calculator might be the best solution for occasional use. A wide variety is now available, including graphing calculators. A simple notepad calculator, *MyScript*, on which you write with a finger or stylus on the screen is editable and fast, a useful app and good for teaching maths and as a field calculator.

For analysis of pairs  $(x, y)$  of data the scientific *DataAnalysis* app provides a wide variety of curve fits and basic analysis, as well as export options. However, it does yet not accept a csv file, although this may not be a major problem.

The increasingly popular programming language Python has an iPad shell *Python Math* for command-line data and there are apps using this for a variety of tasks. For Unix aficionados, *Vim* is available along with other tools that are probably beyond the needs of most fieldworkers. They do however show the ingenuity of programmers in turning a ‘toy’ into a scientific tool.

## 2.10 Data Collection and Loggers

As mentioned previously, the on-board sensors (accelerometers) in iPads have allowed several apps and features suitable for fieldwork. These include the seismometer (e.g. *iSeismometer* see Takeuchi and Kennelly (2010) for laboratory demonstrations), the clinometer which is utilised in some of the ranging and survey apps mentioned above and for geological applications such as *lambert* which are mentioned in Chap. 8.

*EasySense* is an app that takes data from a variety of sensor devices, mainly for laboratory use.

There are, to date, relatively few plug in sensors for iPads. A useful one, at some expense however as it has the temperature sensor (PRT) as a physical plug in is *iCelsius* (see Chap. 8).

*iBeacon* technology (see Thompson 2013) enables a device to transmit its position to another device e.g. Smartphone or iPad, through Bluetooth technology. This has the potential to be become widely adopted. The Department of Geography, University of Otago, New Zealand have trailed this technology by attaching *iBeacons* to river gravels to monitor and trace their movement after storm and flood events.

Colleagues (Trevor Collins and Sarah Davies) at the Open University, UK, are exploring new ways to record real-time data through relatively inexpensive Bluetooth enabled devices such as *SensorTag*, *SensorBug* and *Wimoto*. Any Android or IOS device can connect wirelessly to these low-powered sensors, to interrogate and download the stored data.

## 2.11 Summary

This chapter has listed the various functions of tablets and Table 1.2 describes the wide variety of ways in which you may wish to use them. We encourage you to think of imaginative ways of doing things to enhance your modules and fieldwork by using this information and the schemes in Figs. 1.1–1.3. We provide case studies in the following chapters to illustrate technology use under educational situations. In some cases we have just made suggestions of how particular facilities (such as audio devices) and apps might be used.

We would like to stress a likely difference between you, as tutor, and your students. We hope you become familiar with the range of things that can be done with tablets and browse websites for other examples. However, while your students may be familiar with the use of tablets and/or smartphones they may not be familiar with using them to support their learning. Students will almost certainly need to be shown what can be done and the wide range of apps that are available. We have tried to give instances in this book. Over time, the concept of Bring Your Own Device/Technology (BYOD/T) is becoming increasingly well known within education as a means for students to use their own devices within formal education activities.

Having set the educational scene we now look at ways in which the items in Table 1.2 can be introduced into student activities.

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<http://www.springer.com/978-3-319-20966-1>

Enhancing Fieldwork Learning Using Mobile  
Technologies

France, D.; Whalley, W.B.; Mauchline, A.; Powell, V.;

Welsh, K.; Lerczak, A.; Park, J.; Bednarz, R.S.

2015, XVII, 156 p. 27 illus., 24 illus. in color., Softcover

ISBN: 978-3-319-20966-1