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NORTCLIFFE, Anne <<http://orcid.org/0000-0001-6972-6051>>, MIDDLETON, Andrew and WOODCOCK, Ben

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## Evaluating the Use of Audio Smartphone Apps for Higher Education

Anne Nortcliffe<sup>1</sup>, Andrew Middleton<sup>2</sup>, and Ben Woodcock<sup>3</sup>

<sup>1</sup>Department of Engineering and Maths, Sheffield Hallam University, Sheffield, S1 1WB, UK  
[a.nortcliffe@shu.ac.uk](mailto:a.nortcliffe@shu.ac.uk)

<sup>2</sup>Learning Teaching Institute, Sheffield Hallam University, Sheffield, S1 1WB, UK  
[a.j.middleton@shu.ac.uk](mailto:a.j.middleton@shu.ac.uk)

<sup>3</sup>Department of Engineering and Maths, Sheffield Hallam University, Sheffield, S1 1WB, UK  
[bwoodco2@my.shu.ac.uk](mailto:bwoodco2@my.shu.ac.uk)

### ABSTRACT

Digital audio technology has garnered interest in Education recently, being deployed by early adopter academics to provide audio feedback. Students have also used it, gathering audio notes on their personal devices to enhance their learning. However, the sharing and distributing of the recordings is time-consuming and requires separate technology. Smartphones with audio apps are able to support recording and distribution/sharing of learning conversations more effectively because of their additional customisable and integrated functionality. This is attractive to Education now that it is clear that smartphones are becoming ubiquitous on campus. This paper describes an evaluation of audio apps for recording conversations by an academic and students and their experience in using smartphone audio apps to date.

### 1. INTRODUCTION

Academics value the pastoral nature of teaching and the formative affect upon productive teaching and learning relationships. The growth of Higher Education (HE) has led to intensification of the academic workload, [1] and reduced the time available for all academic tasks, in particular the preferred academic related tasks. In reality all students need pastoral support in order to

assist them to reach their full potential and aids at an institutional level improving student retention, [2] However this is not exactly economically viable in the reduced funding and the 'proliferation of HE, [3]

Therefore some academic innovators have turned to technology to simply, efficiently and effectively restore and develop the connectivity they have with their students. For example some academics have used digital audio technology to provide more constructive and supportive assessment feedback, [4].

## 1.1. Literature Review

Digital audio technology is now more accessible and easier to use [5] and this had led to academics, who have traditionally not been early adopters of the technology, to produce audio feedback for students on their work [6]. Students have also begun to appreciate how audio can give them more control, [7]. When students were presented with an MP3 recorder as part of an educational research project to identify how students would use audio technology to enhance their learning; the students acted independently of the project, demonstrated recording many different, useful and valuable learning conversations for themselves and their peers; from teaching, feedback, to personal notes[8].

The literature shows that audio technology is highly adaptable for learning, from providing effective guidance to learning through voice intonation in multimedia learning resources, [9], to the blending of audio resources of audio lecture notes and feedback, [10]. Audio feedback has also shown to enhance student and staff relationship, perceived increase in personalized communication being in the audio format opposed to written, [11]. Audio feedback in particular has demonstrated that the technologies and methods are mostly highly adaptable and can be used effectively to meet the particular needs of students and staff [6]. However, to enable academics to address the balance between high student numbers and dwindling academic resources, there is need to improve methods for audio file management and distribution, [12].

Even though it is widely accepted in the literature that the post-production of audio feedback recordings is neither necessary nor reasonable, existing technical infrastructure in universities is inadequate for managing and distributing feedback recordings, [4], [12-13]. It is unlikely that there will be widespread adoption of audio-enhanced learning unless such methods are refined to support seamless, effective and sustainable practice. Equally, for students, audio files need to be accessible, easy manageable, and fulfil their recording requirements, for example being able to record an academic in a lecture theatre to the management of personal notes and the sharing of recordings from group-based learning activities. The use of MP3 recorders and PC audio software fall short, therefore, in supporting the variety of the learning conversations and the management, distribution of audio files easily as it requires additional technology.

## 1.2. Alternative Approach

Smartphones with voice memo apps, on the other hand, are able to support the recording and the distribution process more effectively due to their additional functionality and communication tools. At the same time, personal smartphones are becoming ubiquitous on campus, being used by both academic and student users to support personal and academic activities. However there are a number of audio applications for smartphones which is expanding and varying widely in price, functionality, audio file format, quality and usability. Initial evaluation of smartphone audio apps for educational purposes has been conducted and has led to early experiments by the author to use their *iPhone* for producing and distributing audio feedback, and to student groups who use their smartphone in and outside the classroom, [14].

## 2. RESEARCH APPROACH

### 2.1. Academic using an audio app

The research approach adopted was to identify an *iPhone* app for recording and distributing academic audio feedback to students. The research methods applied to evaluate the impact of *iPhone* audio feedback included analysis of: academic produced diary, [15], student surveys, and semi-structured conversations with students, [16].

The identification and classification of *iPhone* app was achieved using the following criteria:

- Usability: Apparently simple functionality set; Uncluttered interface; Consistent use of design compatible with iOS (e.g. email functionality works as expected); standard audio controls.
- Quality: Adequate and controllable sound level, as indicated by GUI; Bit rate and Frequency are sufficient.
- Interoperability: Standard audio format PC/Mac or choice of format or narrow platform audio format.
- Functionality: Recording; Connectivity via Email and other protocols; Tag/bookmark/photos to sections of audio; Wifi Sync.
- File management and format: Renaming; organisation; navigation and file type;

- Distribution features: Email, MMS and address book integration, including file naming for attachments, subject line and message body; integrates with university email address of sender.

| Audio app   | Usability  | Quality  | Interoperability   | Functionality   | File Management   | Distribution   | Conclusion Application Suitability  |
|---|--|--|--|---|---|--|---|
|  <p><b>Voice Memo</b></p>        | Easy to use: press the red button to record, pause, and square button to stop.                             | Indicates the level of sound.  | Playable on a Mac and PC using QuickTime and iTunes, and iPhone. Cannot be played by Windows Media Player.     | Record, MMS, and email small files  | Pre-defined labels can be selected to name the file.<br>Produces large .m4a files.  | Share via email and MMS, but the files lasting longer than 5min are too large to email.                  | Quick audio memory notes to oneself.  |
|  <p><b>Smart Recorder</b></p>    | Fairly easy to use   | No sound level indicator.  | Can be played using on PC/Mac using QuickTime, RealPlayer and Media Player<br><br>Playable on most smartphones | Records, append recording to a file and variety of distribution methods.<br><br>Add tags and photos along the recording timeline. | Produces audio as Wav file, images as JPEGs. Tags and filenames can be amended.<br><br>Aif file format on the iPhone. Exports as a large Wav file and JPEGs | Export the finished file via wifi sync, SyncDocs, email, upload to Box.net, Facebook or Twitter account. | Adding a narrative to images, i.e. storyboard for assessment brief, an academic feedback narrative of a visual student submission or narrative of journey for lecture or assessment brief, digital storytelling.  |
|  <p><b>Audio Boo</b></p>         | Simple to use  | No sound level indicator   |  | Record Podcast and broadcast to public via audioboo.fm.   | Can upload Podcast to audioboo.fm.  | Audioboo fm.   | Audio record and broadcast public lectures.   |
|  <p><b>iSaidWhat?!</b></p>     | Simple, record, pause and stop buttons are intuitive.  | Mic sensitivity control is provided.<br><br>Can share files in low or high quality (smaller or larger file size).<br><br>1 min low quality file is 1Mb. 1min high quality 2Mb. | Can be played using on PC/Mac using QuickTime, RealPlayer and Media Player<br><br>Playable on most smartphones | Records and append to recordings.<br><br>Few seconds of audio snippets can be selected and cut from audio files                   | Large Wav files. Upon saving the user is prompted to name the file.   | Files and snippets can be shared by email, wifi sync, Facebook and Twitter accounts.                     | Sample and share key messages with students, for example accesses brief instructions. Snip key generic feedback can be appended to each short personal feedback.<br><br>Equally, students can easily record lectures near or far from the speaker adjusting the mic sensitivity. Also snip out and distribute key messages. |
|  <p><b>AudioMemos Free</b></p> | Easy to record, pause and stop recordings.   | Can adjust sensitivity of the mic. Lowest quality file format: 1 min file is 1Mb, highest quality 1min is 3MB.   | Can be played using on PC/Mac using QuickTime, RealPlayer and Media Player<br><br>Playable on most smartphones | Can add bookmarks whilst making a recording. Can overwrite audio files or append recording to file                                | Auto Name for file is default as date and time, just need to append subject.<br><br>Large Wav file.   | Send via email or to a server cloud.   | Audio record student questions and answers whenever they occur in tutorial or lecture. Share via server with students. Short two minute email audio feedback attachment, providing verbal feedback on an assessment submission. The file is accessible as interoperable.  |
|  <p><b>iProRecorder</b></p>    | Tactile controls mimicking iPod controls. Easy to record, pause, stop recording, play, forward and rewind. | Can vary the quality of file saved and shared. ½ hr audio low quality 38 Mb.   | Can be played using on PC/Mac using QuickTime, RealPlayer and Media Player<br><br>Playable on most smartphones | Can easily add book marks.  | Name files.<br><br>Large Wav file.  | Share via email, wifi sync. Can only share short files.  | Ideal app for students to record entire lecture, marking the audio file at the point of start of new lecture sub-topic or change of slide.  |

|  |   |  |   |   |  |  |  |
|--|---|--|---|---|--|--|--|
| <b>Audio Notes</b><br>  | Easy to record, pause and stop recordings. However finding settings function is less intuitive.   | Can vary quality from min. low, medium, high and max. For all quality settings 1min files is 520Kb           | iPhone 4 or iPhone with OS 4. Format CAF requires on PC/Mac to use QuickTime<br><br>Will not play on Android Phone. | Can append written notes and information to file.. The recordings are geo-tagged, identifying where the recording was made. You can password protect files. Also, it is possible to set audio file as a calendar event alert. Colour theme the recording. | It supports file naming. Colour coding helps you to organize the recordings. Uses m4a or CAF file format.  | Files can only be accessed and transferred from the iPhone via connecting to PC or Mac using iPhone explorer   | Recording narratives especially where it is useful to identify locations. Audio introductory commentary to campus or city to aid orientation. Students could use the app to record learning conversations with tutors about an assessment, organise and colour code files for each assessment. |
| <b>Recorder Pro</b><br> | Easy to use, record, auto pause (records when it hears sound), stop, rewrite, play, zoom to sections to play.                           | Audio quality 8KHz, 22KHz, or 44.1KHz.<br><br>½ hr low quality AIFF file                                     | Playable on QuickTime and RealPlayer 8 Plus. iPhone 3 and 4.<br><br>Will not play on all Android Phones.            | Append to recording new recording. Rewrite file and bin file.   | Good file management features, possible to name and rename files and organise into pre/user defined folders. Search for files. Audio format Aiff or CAF. | Share by Email, fully integrated to email set up in the phone and users contact details.   | Audio record project supervision formal, informal and semi-formal, email to the student. Audio record and re-distribute one to one. Audio Feedback on assessment, quick and easy to distribute.  |
| <b>VR+</b><br>          | Easy to use. Red button to record, conventional pause and stop buttons.   | Audio quality 32kbps, 64kbps, 128kbps, or 192kbps. File size conveniently small, 7min file at 64kbps is 3MB. | Playable on QuickTime, RealPlayer and Media Player<br><br>In principle most Phones and MP3 players.                 | Auto voice activation facility.   | Files can be categories by icon, but limited in number of icons provided.<br><br>Audio format MP3.   | File can be shared by email, Facebook, twitter, MySpace and podcast using the VR+ Online service.  | Ideal for academic to podcast reflection of sample of class assessment 24hrs after assessment submission.<br><br>Suitable for small class individual assessment feedback emailed, large cohort difficult without file management. MP3 is popular with students as interoperable.               |
| <b>voiceNote</b><br>  | Green button to record. Blue Button to Pause and Yellow Button to stop button, Red Button to delete. Not consistent with other devices. | Sound level indicator.<br><br>Cannot vary quality.   | In theory would play on QuickTime, RealPlayer and Media Player.<br><br>In principle most Phones and MP3 players     | The facility to rename file and audio append to a recording.  | Start by naming new file, before start recording. MP3 format   | Sharing facility by email but not operable or integrated to the phone email setup i.e. contacts etc. Files require retrieving via Mac or PC using iPhone explorer. | Ideal for planned recordings, for example audio feedback on assessment submissions to be uploaded to Virtual Learning Environment (VLE).   |

Table 1: Evaluation of *iPhone* recorder apps

## 2.2. Students using audio apps

Just as many professionals from medical professionals [17] to academics [18] are exploring smartphone apps to aid their management and application of their everyday professional tasks, the question is; “*Are students harnessing the technology for learning?*” Students at University were invited to anonymously participate in an initial survey on *Facebook* to identify if any students were using smartphones and audio apps for learning.

## 3. EVALUATION OF SMARTPHONE AUDIO FOR LEARNING

### 3.1. Evaluation of Audio apps

10 apps were short-listed in October 2010 for evaluation. Table 1 illustrates the analysis of each of the audio app against the research evaluation criteria.

The identification and classification of the *iPhone* apps in Table 1, indicates that the *Recorder Pro* app for the *iPhone* would be the most suitable application for recording and distributing personal audio feedback to a large co-hort of students. This is as the functionality appears to work well and is a flexible tool that enables users to organise and search files post recording, and is

fully integral to the email application and contacts on the *iPhone* and mail contact database, which simplifies the process of looking up and inserting email recipients email address details. The app fulfils the requirements for the academic, it fits well in terms of its functionality and adaptability for working around the academic's professional and life commitments. However it would require the students to have access to workstations with *QuickTime* installed.

### 3.2. Student Survey Reflections on Academic Smartphone Audio Feedback

130 Engineering and Computing students received personal audio feedback, on their 4 to 5 page employability assessment submission, which was generated and email distributed using the *Recorder Pro* app. Each student was advised in the email contents that the attached file was their personal audio feedback file on their assessment submission and were advised to play the file using QuickTime. The students were anonymously surveyed within six days of receiving the feedback. 45% (59 students) of the 130 Engineering and Computing students responded in the survey on the audio feedback that they had listened to the audio feedback within six days of receiving it. The student survey response to a free text question as to "Where and what do you listen to the audio files?", indicated that 76% (45 students) played and listened to the audio feedback file on a PC based platform, i.e. workstation/laptop/netbook, From this number 4 students indicated that they listened to the files on University workstations, and 49% (29 students) listened to the file on a PC device at home and 1 listened on a fellow student's PC in their peer's accommodation. 7% of student (4 students) listened to the file using an *iphone*, one indicated that they listened to the feedback whilst in the University, one at home, the remainder did not explicitly indicate location. 4% (2 students) indicated listening to the file on their Apple Mac, one at home, the other did not indicate location. The reminder of the students indicated where they listened to the file, i.e. at home, but no indication as to the device they used.

The Likert scale questions in the survey were to primarily identify the student's perception of receiving smartphone audio feedback in respect to Gibbs & Simpson's conditions for good assessment feedback for learning [19] and Nicol's design principles for good assessment feedback [20], the results and analysis of these questions has been reported elsewhere, [18].

However the survey questions asking about the quality and timeliness of the feedback, also provide an insight to the student evaluation of the hardware suitability for recording and distributing audio feedback and therefore a summary of the results is reproduced in this paper.

The student response to the question "*Is the feedback of good quality*", 80% students agreed or strongly agreed, 3% disagreed with the quality of the audio feedback, 17% indicate either maybe/don't know/neutral. This result can be interpreted two fold, one an indicator as to whether the quality of the contents of the feedback was good, but a lso whether the audio sound quality was good. This is that if the sound quality of the audio was poor the contents of the feedback would be inaudible therefore the listener would express dissatisfaction at the quality of the feedback.

In response to the timeliness of the feedback question; "*Was the feedback provided quickly enough to be useful?*", 93% students agreed or strongly agreed, 7% indicated either maybe/don't know/neutral, therefore indicating that the methodology is an efficient method of creating and distributing feedback.

The student reflections support the approach, that the majority of students are able to access and play /listen to their audio feedback file, and indicate no interoperability issues in the survey. Therefore the app fulfils the student requirement in providing quality and efficient method to provide timely feedback.

### 3.3. Student Interview Reflections on Academic Smartphone Audio

The focus of the interviews was primarily to enquire as to the impact of the audio feedback upon the student learning; however the encoding of the interview transcription highlighted unsolicited students' reflections on the hardware, software and quality of the approach, as shown by the following student comments;

- "*It is a very interactive way of getting feedback, nice and quick, you can play it again and again*"
- "*It just feels more so [interactive], you get written feedback which doesn't feel the same as someone speaking to you*"
- "*I know it sounds stupid, sometimes you cannot actually read their writing , nice to listen to an actual voice*"

Implying that quality of the audio feedback was more than satisfactory as the audio file was akin to speaking face to face.

The students also commented upon the fact that the file format is not ideal for interoperability for PC users, as it requires iTunes or QuickTime on a PC, as the file format is not compatible with MS Windows Media Player, so is an inconvenience for students. However the students noted that the file format can be played on mobile devices, i.e. digital audio players. Also students noted another positive point about the benefits of digital feedback is that the audio file is easier to file manage than hardcopy written feedback, as shown by the following student comment:

- *“It's easier to save audio feedback in a file; whereas a bit of paper - you might file it away and not be able to find it again.”*

However this would be true for any digital feedback format.

### 3.4. Academic Reflections Audio App

130 engineering and computing students four to five page written employability assessment submission marked over a seven day period. An average 10 to 20 student submissions were assessed and audio fed back upon per day. This workload was co-ordinated around the academic workload for that week which consisted of attending a ½ day external research event, 10.25hr teaching related contact time activities, and the usual hours of teaching preparation and academic administration workload, in addition to personal/family commitments and duties. The smartphone approach enabled the academic to assess student submissions at anytime and anywhere that a location was quiet; marking took place at their desk when the office was quiet or at home (the majority was conducted at home).

The academic reported upon returning the assessment submissions and audio feedback to the students, that the students were demonstrating more willingness to engage in developing their employability, and were reflecting on their learning and their career plans. Therefore the assessment and feedback was achieving its intended learning objective of increasing students' employability.

### 3.5. Students using Audio App

The research results of the student perceptions of using their own smartphones for learning are on-going. The initial survey results ascertained from a survey posted on Facebook inviting University students to participate, yielded 54 student responses, the results show that the majority of students own an iPhone, Figure 1.

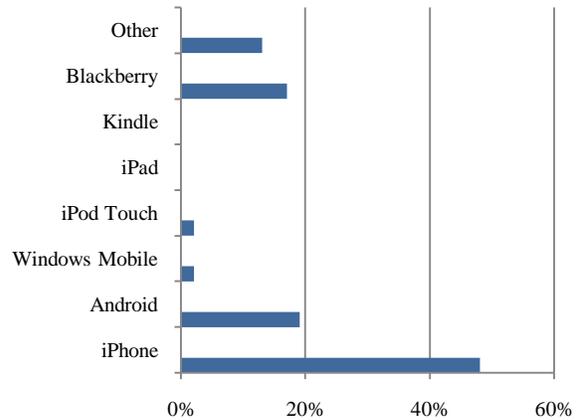


Figure 1: Student distribution of smart devices

The survey indicates that students are using their smartphones for learning, Figure 2, however only a small percentage, 11%, considered or are using audio apps for learning, but some students are clearly using audio apps for learning and therefore it is question of how are students using audio apps for learning.

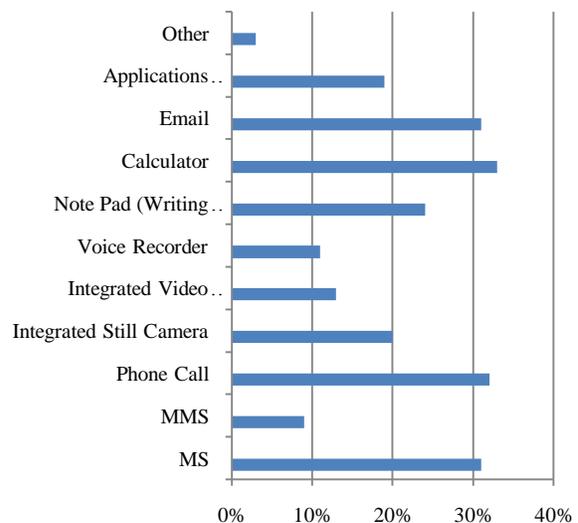


Figure 2: Apps for learning

However the survey results, Figure 3, indicate that students are not prepared to or their finances do not permit extravagant app purchasing. Therefore students are more likely to explore the standard audio app provided on their smartphone first, but as one student has expressed the standard app is less than adequate for their requirements;

- “I used bulk standard audio app... it was rubbish in comparison to [Recorder Pro].app you [tutor] use”

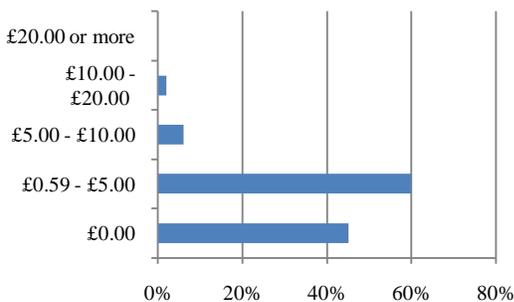


Figure 3: Cost of Apps student prepared to pay

Therefore students need to be exposed to alternative audio apps and their potential suitability and practical uses of the audio apps for learning.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

There is an array of audio apps for *iphones* and smartphones, the majority of the apps on the *iphone* range in price from free to £2.99, each app has potential and practical use by academics and students to aid student learning for learning as shown in Table 1. The potential of audio apps for student learning needs to be communicated and demonstrated to academics and students, if to be encouraged to be adopted for student learning. Any academic considering using an audio app to generate learning resources for students needs to specifically consider:-

- Who is the end user and on what device will they access the recording and interoperability? As the majority of students use PCs based platform systems, the audio file format needs to be compatible for playing on a PC platform, and not an inconvenience, i.e. require the user to install preparatory software.

- How are you distributing the recordings and how does this compare to the usual ways for delivering and receiving feedback? Is it acceptable institutional practice to email feedback? Are you required to distribute digital feedback via the VLE? Or can you utilise a third party system, i.e. cloud?
- Will the students have to be instructed in any way to receive and process the feedback? Are your students IT literate, i.e. are they capable of downloading and installing preparatory software? Or is it a question of the students having suitable open access to workstations with audio functionality in the Institution?

Any academic and student considering using audio apps to generate learning resources needs to consider:

- Is the size of files suitable to be distributed? If not, do you need to find a different quality setting, or use compressed file format to make the recordings shorter, or make multiple recordings?
- Is the quality of the recording suitable? Do you need to test this with users?
- Is the format of the recording suitable? Do you need to test this with users?
- Is/are the person/people speaking close enough to the mic or in environment where background noise is minimal to avoid ambient noise muddying the recording?
- Is it helpful to have additional functionality such as book marks, geotags, or photos?
- How much recordings will be generated and for what? Can the app cope with multiple files and the functionality enable the user to organise and manage the files?
- Do you need to keep, re-write or delete files after distribution?
- Do you need to edit files, i.e. re-write, snip them or append them?

The research recommends that staff and students who wish to use the audio apps need to have their own smartphone, as institutions rarely fund and support academic smartphones. Staff and students need to

experiment with the apps to find out which ones are most suitable for their needs, identify the suitability of the app for the intended learning application, also the ease of use, perceived ease of use and self-efficacy of the app.

Further research is required to identify which audio apps are used or likely to be used for learning, and the importance of user's acceptance and attitude towards smartphones audio apps for learning. In particular investigate users acceptance, perceptions and attitudes towards audio apps in the terms of self-efficacy, perceived usefulness, and perceived ease of use, as per the assessment of smartphone acceptance by health professionals [17].

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