Digitalisation of Qualitative Research through a Mobile App: A QualNotes Blueprint

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"QualNotes" is a qualitative data collection app with interactive and collaborative functionality designed to streamline the use of qualitative methods in research and teaching

Introduction

Qualitative research is an integral part of the social sciences and humanities, preparing students to understand, react to, and productively thrive in contemporary society and the digital world (Kara 2020). However, the teaching of qualitative methods often relies heavily on traditional physical materials and 'how-to' styled textbooks (Hood 2006). Compared to disciplines such as engineering and architecture, which have fully embraced digital tools like Adobe BIM and CAD for use within and beyond the classroom (Abdirad & Dossick 2016), the social sciences, and particularly in qualitative data collection, have been comparatively slower to adopt digital technologies, especially to aid data collection (Bano et al 2023; Dicks et al. 2005).

To collect data in the field, researchers often use multiple devices: stand-alone cameras, voice recorders, printouts of maps, and pen and paper forms for consent and data collection (See Figure 1). While software for analyzing collected data (downstream) is common with tools like NVivo (first released in 1999) and Maxqda (first released in 1989), digital tools in the data collection phase (upstream) are less prevalent. The QualNotes app aims to bridge this gap by digitizing the process Dickinson et al. 2020; Shilon 2023; Twis et al. 2020; Wikstrøm 2023).

QualNotes is a comprehensive software solution available as a WebApp, desktop, and mobile application. It is designed to (1) collect data using qualitative methods such as mobile mapping, (2) facilitate interactive teaching of these methods in the classroom, and (3) digitize the management of data collection research projects. Released as open source on GitHub (see code at [Github](#)), the app enables researchers to create projects, invite collaborators, upload and sign ethics forms by team members, and get participants to sign documents, thereby reducing the use of paper forms. The app supports three field data collection methods: (1) mobile mapping, (2) interviews, and (3) participant observation.

We have piloted teaching qualitative methods using the QualNotes app. Specifically, we integrated the app in teaching field-based data collection and in two research projects involving mobile methods. In the first example, QualNotes was used to instruct students in a second-year qualitative methods course on interview methods. At the start of the lecture, students received a QR code invite to join a project already set up by the instructor. Once they joined, we collaboratively discussed and created the interview guide, with the guide visible on both the students' phones and the classroom's projector. The question list updated in real-time allowing us to discuss question content and order the questions interactively.

In another exercise, master's students in a Landscape Geography course used QualNotes to construct mobile maps as part of a landscape reading field assessment. The students added annotations on their own maps as they walked through an area of the city, which included different media (photos,

sound/voice recordings and text notes) to the map. They then used the maps (viewed on their laptops or desktops) to analyze the data to write their field essay.

Similar to the mobile methods teaching exercise, in two research projects being conducted in Stockholm, Sweden, and Leicester, England, researchers have created a project in QualNotes, invited other collaborating researchers, and then used the App to collect research data with the interview and mobile mapping functions. The benefit of the collaborative project function has been that each researcher, collecting data in different locations, can add their data to the project, allowing the collaborating researchers to view, share and organize project data within the App.

In the sections that follow, we will explore how to use QualNotes for creating projects and collecting qualitative data using the QualNotes.

Background to Mobile-based Data Collection Applications

The effectiveness of researchers gathering data in the field is often constrained by the tools at their disposal. The use of modern digital methods, particularly those involving smartphones and various applications (both free and paid), introduces a range of misaligned incentives most commonly related to usage and sale of metadata for purposes not related to the app's original purpose. These include challenges in usability, varying costs, a lack of customization to suit diverse needs ("one-size-fits-all" problem), and significant concerns about data privacy. Additionally, the dominance of paid applications in this space exacerbates the digital divide, potentially disadvantaging researchers or institutions with limited budgets.

Notwithstanding the digital divide, smartphones have become an enabler in everyday life; while they can replace all the tools shown in Figure 1, this enabling capacity has not readily transferred to research and teaching (Paulus et al. 2017). Our smartphones not only enable us to collect data in digital format from the source but also provide less hassle and lower costs to data collection, and also facilitate new ways to collect data, share it, and even crowdsource it too (García et al. 2016; Venter et al. 2023). While traditional paper-based data collection offers standardized depth and granularity, it is worth noting the disadvantages of analog data collection methods:

- **Shareability and Integration:** Analog data inherently presents hurdles when it comes to sharing, collaborating, or integrating with other software platforms. It can also present data security issues when signed consent forms are erroneously kept with data collected, and/or data is stored on multiple users/collaborators laptops increasing the risk of data theft.
- **Time-Consumption:** For dissemination and analysis most data is digitized. Digitizing paper-based data can be a lengthy process.
- **Scalability Issues:** As projects expand, managing paper-based data quickly becomes unwieldy.

While the initial target audience is within tertiary education institutions, the QualNotes app can be used by anyone undertaking qualitative methods, field-based research, *and* attempting to overcome the disadvantages of analog data collection listed above. For example, organizations conducting interviews and/or field assessments will benefit from the integrated data collection features and the collaborative functions among teams. The tool has use-cases for planners, engineers, and landscape architects, government agencies, non-government organizations, and other groups involved in urban and town planning, social service and employment service offerings, and migration departments. Students of social sciences and humanities disciplines will likely find employment in one of these industry sectors; we envisage a cascading effect from students having used the app in the classroom and then translating these skills and use of the app into their chosen careers.

Figure 1. Set of tools researchers typically carry during data collection in the field: (1) laptop, (2) prompts for elicitation, (3) paper notes & consent forms, (4) communication device or smartphone, (5) voice recorder, (6) digital camera, (7) map. Source: Author's own image.

Building QualNotes for teaching and research

With QualNotes, we address the gap in digital qualitative data collection while ensuring robust research ethics and integrity compliance not possible with pen and paper. There were three key design choices guiding QualNote's development:

1. Use the free and open source map service OpenStreetMap to keep development costs low (Haklay et al. 2008).

2. Use of the development framework "Flutter" (Windmill, 2020) where a single source code can be compiled into a web, iOS, or Android app with minor tweaks in the configuration files. Flutter reduces the costs of separate platform-based development teams.

3. Adopting Google's pay-as-you-go Firebase to store data (Ayezabu 2022). Leveraging a managed cloud infrastructure allows one to scale the number of users without the need to worry about scaling the backend or servers (Allain 2020).

In addition to the three data collection methodologies–participant observation, mobile mapping, and interviews and interview guide creation (as explained in detail in the next section)–other features include:

- **Workflow management:** The stepper is a guardrail designed to support students in compliance and good project management practices. It provides the best-practice chronology of a research project, modelling how to use and collect qualitative data in a step-by-step process.

- **Multimedia Integration:** Users can capture and integrate images, text notes, and audio. By prompting students (and other users) to integrate a variety of media sources, QualNotes' design seeks to encourage the collection of other data sources alongside text to show how such multimodality contributes to better understandings of the research data (Rose 2022).

- **File Repositories:** Modern cloud-based access enhances data security.

- **Collaboration and Sharing:** Built-in tools allow for real-time collaboration and data sharing. Collaboration is a foundational feature, both in terms of the app's functionality and use but also its development and design (Drozdzewski and Berengueres 2024).

- **Export:** The App can export project data in JSON format to other software tools.

Workflow Management for Using QualNotes

The following section comprises a step-by-step guide to setting up a new project, as well as the use of the stepper tool. This guide offers instructions for a stand-alone user, and also provides directions for how an instructor may use the app in the classroom. Once a user has installed QualNotes on their mobile device, they are prompted to verify their email. After the user's email is verified and they have consented to the privacy policy by checking the boxes, the App will open to a blank 'Your Projects' page.

To start a new project, users click on a standard blue '+ Project' button and are prompted in a popup box to create a project title and hit ok. The user who first sets up a project is, by default, the sole administrator (this status means they can invite others to collaborate on a project and delete collected data too (see Step 3). Once the new project screen opens, users are provided with a welcome screen with three tabs in the top ribbon (see Figure 2). To continue to 'Set up' the project, users are instructed to do so in the 'Set up' tab.

In a classroom setting, the administrator would be class instructor; they would set up a project and then invite the students to the project using the QR code. The students would all have had to independently create a user account as described above first.

Step-by-step guide: 'Set up'

The 'Set up' is organized in five steps:

1) Ethics and Consent Portal:

This portal enables the upload of a PDF version of a Participant Information Statement and Consent Form, as issued by the user's own ethical review board. It is a purposeful first step designed to prompt students (and other users) to complete the ethics prior to data collection. Both ethics documents can be shown to participants, the 'Sign Form' button is greyed out until both ethics documents are uploaded.To consent (see Figure 2), and upon clicking on 'Sign Form' (1) a PDF of the Participant Information Statement (2) and a PDF of the Participant Consent Form (3), will be shown in sequence to a participant. The right-hand screen in Figure 2 shows the consent collected digitally from "Jane Doe" who has signed with their finger (4). Upon saving, the signed consent form is then stored in a secure server located in a GDPR compliant country (5). These signatures are held in different cloud-based folders from the participant data in the database to comply with GDPR. Further information on data storage is provided in Step 5 'Post Data Collection'. For students, this step provides a chronological indication about where ethics should be placed in the collection of qualitative data. However, as most classroom-based projects do not require formal ethics, in the classroom the instructor can upload a draft or mock version to simulate this process for students. In the classroom-based interview exercise, we used the ethics portal

to remind students about the necessity of obtaining consent before collecting data from participants. Thus, even though we did not upload documents, it was still a crucial talking point as to the process of ethical data collection.
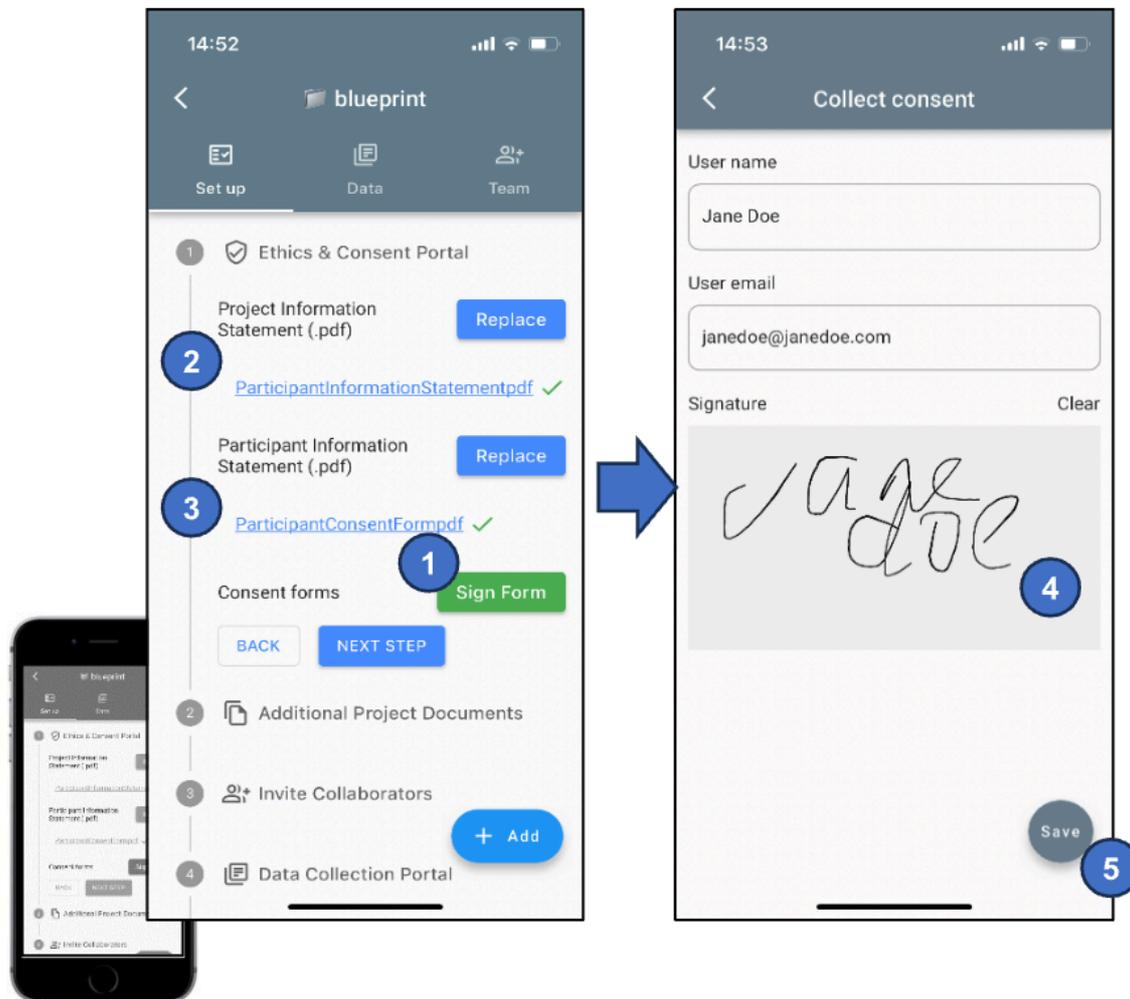

Figure 2. How to collect consent from a participant with QualNotes App.

2) Additional Project Documents:

In this second step users can upload other documents that are necessary for the data collection process. For example, urban planners may upload development plans, maps, or previous site photos. What is uploaded in this step very much depends on the context and/or topic of the project. For example, in a potential classroom exercise on sense of belonging in the neighbourhood, the class instructor may upload the neighbourhood strategic plan, older maps of the area, and/or images taken from the neighbourhood. The aim of this step is for the project folder to act as a repository for documentation that may be useful and/or used while collecting other data.

3) Invite Collaborators:

There are three ways to invite collaborators within the stepper via (1) a web link, (2) QR code, (3) a scan code provided by a project administrator. The rationale of incorporating a collaboration function is that multiple users can add data to the same research project and view collaborators' data too. If you are a collaborator on a project, you can view other collaborator's data within the same project. An

administrator (or course leader, for example) could set up multiple projects with individual students if, for example, the data being collected requires a higher level of privacy. However, in a collaborative teaching scenario, the sharing and viewing of data is part of the learning outcomes so that it creates a dynamic classroom environment through its real-time sharing capability, where an instructor can invite their students as collaborators and can, for example, create an interview guide in real-time with students adding new questions to the interview guide.

In the classroom exercise mentioned in the paper's introduction, the instructor showed the QR code of the project to the students on the main screen; the students (who had already logged into the QualNotes app) then scanned the code with their phones and accepted the invitation to join the project. The students could then scroll to the interview question guide already created for that project. As we discussed question type, content, and position, students could see the interview guide change in real time on their phone as the instructor was moving around questions on the main screen.

Outside of the 'Set up' function, a project administrator can also invite other users to the project by using the 'Team' tab, where the administrator can select 'Add people' while also managing who is currently collaborating on a project. A new collaborator can scan an administrator's QR code on the main 'Your Projects' screen. Clicking on the QR code icon in the top right of the screen opens the camera function to scan a code. Having the administrator- only 'add collaborator' function creates an important safety step in classroom-based teaching, so that students are unable to add collaborators outside the classroom-based exercise.

4) Data Collection Portal:

In Step 4, users collect qualitative data (see Figure 3). Once the user has clicked on '+ Add', they are presented with the five options–participant observation, mobile mapping, interview guide, audio interview and video interview. Each method option is used to collect qualitative data, and is explained in that same order below:

a) Participant Observation

Instead of using pen and paper to record field notes—a staple data format in participant observation—in QualNotes, users can type or voice record fieldnotes. Figure 4 shows the sequence of screens and steps that follow. After selecting 'participant observation', users are prompted to enter a title for the observation (1) and click ok. Users can also add photos and audio to their observations. To add a text note, photo or audio to a participant observation, users click on 'New Data' (2), then 'Text' in the pop-up box (3), and then type the note (4). The collected notes appear in reverse chronological order as a list (5), or geolocated on a map by clicking on the map icon top right (6). By rotating the phone's screen to landscape position, the user can view the geolocation of notes added. All data entries are timestamped and geolocated.
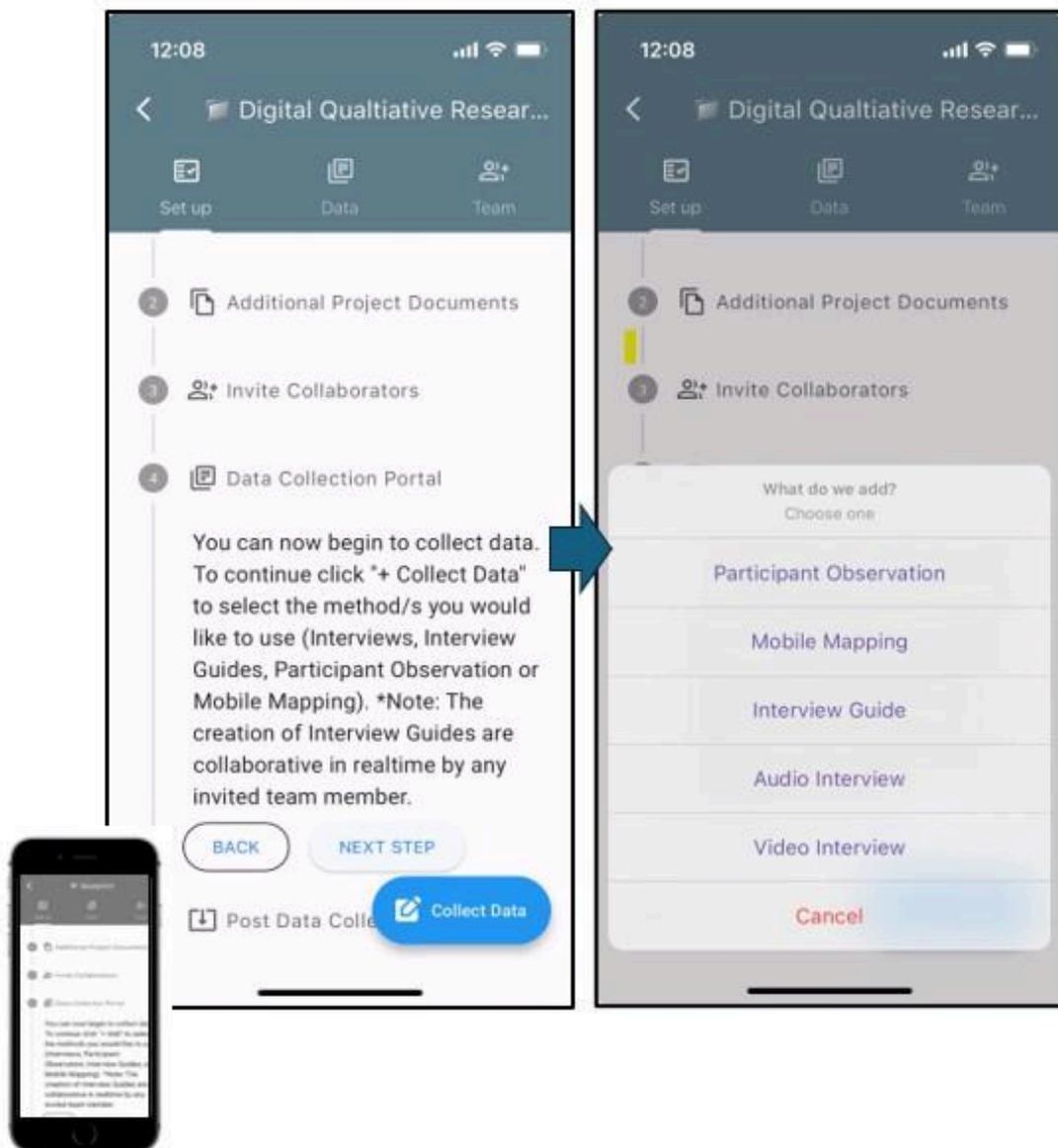
Figure 3. How to Add a participant observation in the Data Collection Portal of QualNotes App. (1) Click on "+Add" (1). Selected Participant Observation (2).
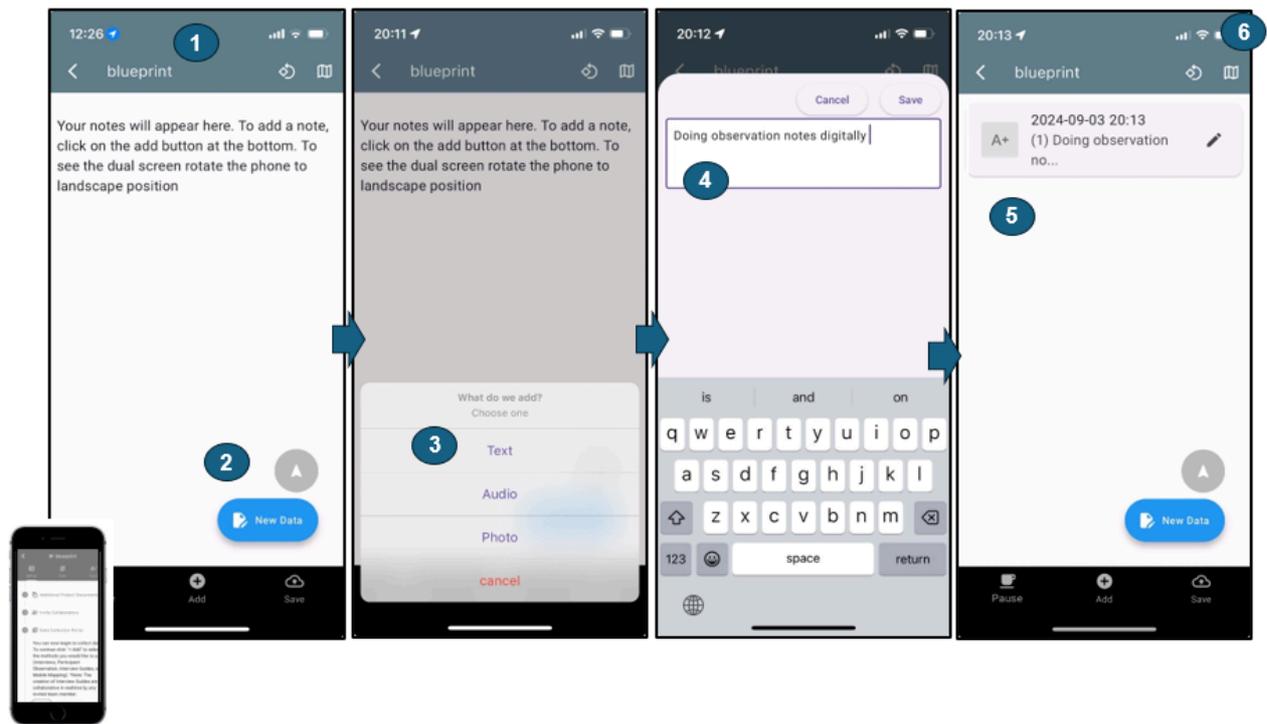
Figure 4. How to add a text note in a Participant Observation (PO).

b) Interview Guide

This function enables users to create an interview guide, which is a list of questions to be used in an interview. After selecting 'interview guide', users are prompted to enter the title and click. Clicking the blue '+ Question' button in the bottom left of the screen opens a pop-up box where the user can type the question, then click 'Add question' to have it saved to that interview guide.

Once a question has been added, a photo can also be added from the image gallery on the user's device by clicking on the image icon on the right of the question. The questions are collaboratively reorderable allowing for a collaborative card-sorting and ranking. Once the interview guide is finished, clicking the arrow button at the top left of the header exits the interview guide.

A key collaborative feature of the interview guides is the real-time function. In a classroom setting, for example when teaching how to create interview guides, students might be asked to add questions to the interview guide, which can then be discussed in class, reordered, and/or deleted. The interview guide can be shown live on the projector while also being on the students' devices

c) Interview

To use the interview function, users again click the blue 'collect data' button, and then select and click either 'audio interview' or 'video interview'). For video interviewing, the interface will show a split screen; half of the screen is the video recording window and the bottom half the interview guide (see Figure 5). When the user selects 'set interview guide', all the interview guides the user has created in that project appear on the screen; once one has been selected, it loads in the bottom half of the screen (right image in Figure 5).

To record the interview, press record. The user has the option of recording using the front or back camera. As the interview questions are asked, the interviewer can tick them off using the box on the right

of the question. Completing this action means that the specific question is time stamped in the recording (see section on 'Data' for how to watch the interview recordings). The recording can be paused using the 'REC' button in the centre of the bottom ribbon. Users must be sure to click 'save' in the right-hand corner once the interview is finished.

If the user has included photos in the interview guide and is using the photos as part of a photo elicitation method–once the interview is recording–the interviewer can tap on the icon of the photo and the photo will populate the screen so that the interviewee can see it.

When using QualNotes with a class, once the class determines the correct question order, the students can use that interview guide to record an interview, either with each other in pairs or small groups. Student feedback from a class that has performed this recording exercise included a positive assessment of the inclusion of the interview guide on the phone screen, as the interview was being recorded. As in a research setting, the researcher or course leader will explain how the recording device (in this case the mobile phone) will be set up in front of the person being interviewed. To build rapport and maintain best practice in the introductory stages of an interview, the interviewer shows the participant (or student being interviewed) the screen view that they will be recorded with, and also how the questions that are listed under the camera view too. The interviewer also explains that to record the order of the questions, they will tap the check box next to the question when they are asking the question, thus informing the participant why they are touching their phone during the interview.

The process with the 'audio interview' mimics the video function but without the camera.

Following the interview recording exercise, the students then watched the video back to listen to the responses, scroll through the recording, and watch how the participant responded (see 'Data' section below for more on how we have used the video playback in the classroom). Feedback from that exercise noted that the QualNotes function found most useful was: *"The fact that you can record the interview while you have a check list where you can write the main questions you want to ask."*
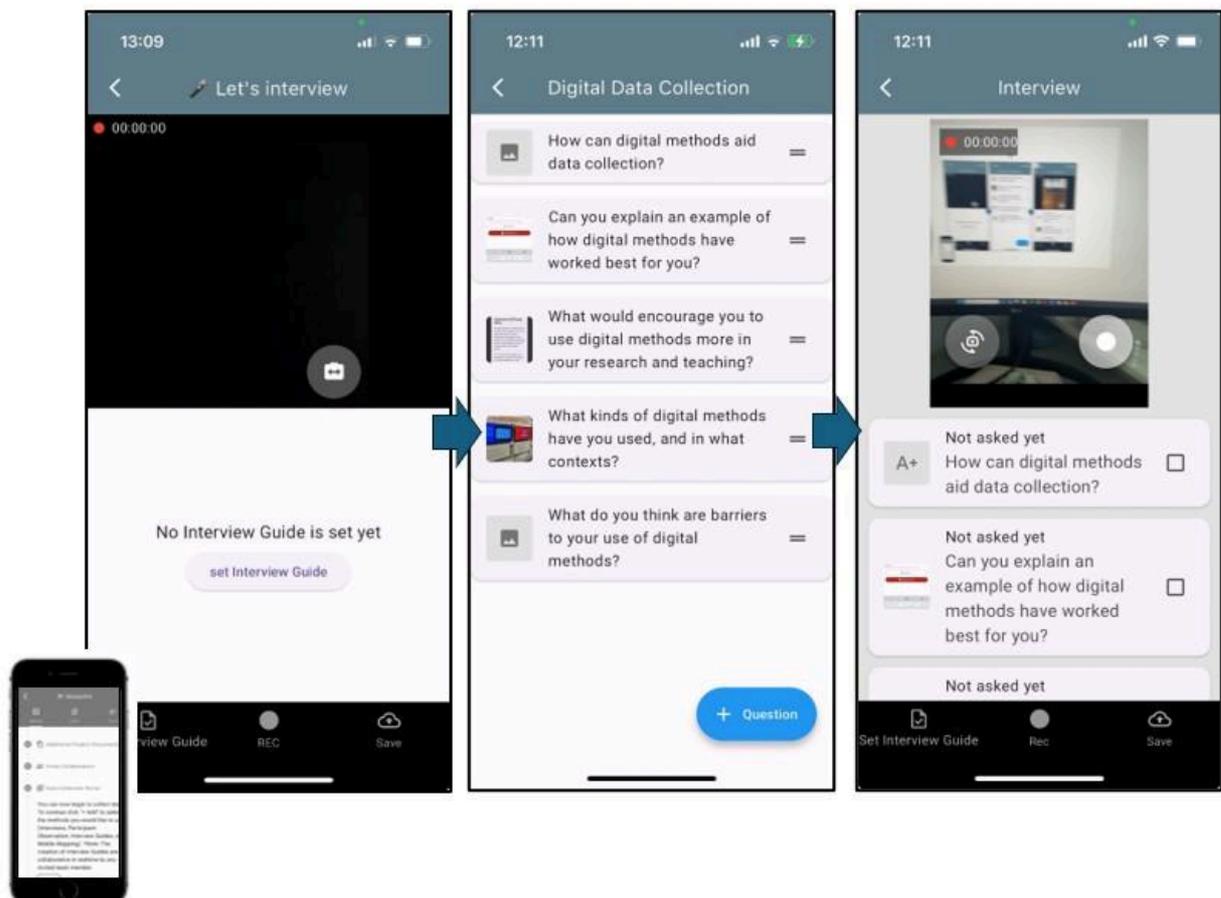
Figure 5. Sequence of screens for interview data.

d) Map

To use the map function, select 'map' from the data collection options (as shown in Figure 3). Users will be prompted to add a title to their new map. The map will load on screen and the user is located with a blue dot. The user can now start mapping. The App tracks movement with a blue line.

Three types of media can be added: audio, text, and photos. By choosing to add a photo, the camera screen will open and you can take a photo; photos are automatically geotagged. A thumbnail of the photo appears on the map.

When 'add' text is selected, a text box opens and the device's keyboard function can be used to type the text note and press 'save'. Once the text note is added, it is geotagged to the map with a red location pin. The notes are tagged with a number that corresponds to the order in which the note is added to the map.

For audio, click 'add' and select audio; the recording screen appears to select the play button to start recording. The progress sound bar shows that audio is being recorded; once finished, click save. The audio recording is added as a microphone icon and geotagged to the map. Finish by saving the entire map. For a visual guide, a tutorial video of the mobile mapping process can also be found (see tutorial here).

When the mobile mapping function was used in the field-based exercise with master's students, the students were given an overview of the app's functionality in the classroom (including the video linked above). Once in the field, we all opened the app together in the start location of the mobile mapping exercise and the instructor demonstrated how the blue dot created a line while we moved.

As we started walking, the students were encouraged to add the media they found interesting in the field location, and could also then see that media being added to the map. One key reminder point during the exercise was for the students to press 'save' several times en route. This directive meant that draft maps were saved (that could be further added to once saved) and prevented the loss of maps due to battery failure or internet connection issues.

6) Post Data Collection:

After the completion of the data collection stage (Step 4), users can download the collected data and consent form(s). The data is saved to the cloud (not the device).

When clicking either 'download consent forms' or 'download collected data', a pop-up box appears providing the user with a URL to the stored data within Firebase. It is also possible to copy the URL and paste it manually to the web browser of choice. The data is in a JSON format, which is easily adaptable to geoJSON format (Butler et al. 2016) or as a flat CSV file; it can be imported into third-party software (GEE, ArcGIS, Leaflet) for further analysis and visualization. See a sample of the Google Earth Engine (GEE) notebook (source here) that uses data imported from QualNotes here (see also Figure 6).

Figure 6. A GIF animation: Digital notes on a map made originally collected with the QualNotes iOS App and later exported to Google Earth.

Also included in Step 5 is a link to 'Reflection' notes. On clicking 'Reflection', a pop-up box opens and users can add a reflection note. 'Reflection' notes and reflexivity are important components of qualitative data collection (Ratnam 2024) and this function enables them to be integrated with the data collected.

Step-by-step guide: Data

The data generated in the stepper, Step 4 Data Collection Portal, is available for the user to view on the main project page, under the centre tab 'Data'. Here, users can view interview guides, as well as completed participant observations, interviews, and maps. The data can also be viewed via the QualNotes desktop webapp for better analysis on a large screen.

For the interviews, there is a playback function of the recording, which can assist with transcription. As the recording is time stamped per question (see instructions under "*c*) *Interview*" above), users can scroll the recording by clicking on the question that they wish to listen to. Interviews can be directly downloaded from the interview playback option by clicking the download icon and pasting the URL into a web browser.

In the classroom exercise on interviewing, the students watched their interviews back. The purpose of watching the interviews, and of opting to code the interview section of the app as video and not just audio (when the audio-only would have used far less memory), was to create what Sumartojo and Pink (2017) have called the video trace. Watching the interviews back in video (not just audio) enabled further instructions as to the pedagogy of listening (Ratnam 2019) and to help students 'better understand participant's gestures, expressions, and tone of voice in their explanations of the interview material (Drozdzewski et al 2021: 46).

The students were also encouraged to use the 'reflection' button in the interview playback (see 'Data' below). Many chose to use the reflection function embedded in the interview playback and pause the recording to add a note about how the participant was answering that particular question, or when they

thought that a question could be asked in a better way (Paulus et al. 2024). Further feedback noted that this function was beneficial as it meant that *"the recording of the video with notes that u [sic] can add at the different timing on the video."* The interview playback thus extended the pedagogical exercise from date collection towards analysis while still in the app itself.

Completed maps can also be played and edited. To play the map, users click 'play' and playback begins at the first registered GPS location, while the map loads in the top half of the screen with the first added media (either photo, audio, or text note) populating the bottom half at the screen. The user can navigate the map and the media they added with the right and left arrows (Figure 7). Users can also opt to edit a map in the 'Data' tab. New media can be added.

After the field-based mapping exercise, and when back in the classroom, the instructor demonstrated how to playback the map on the main screen. We could then collectively and collaboratively walk through the map again. A further pedagogical component was to discuss and provide steps to the students about how the data could be downloaded from the app and used in the production of a photographic essay of the field location.
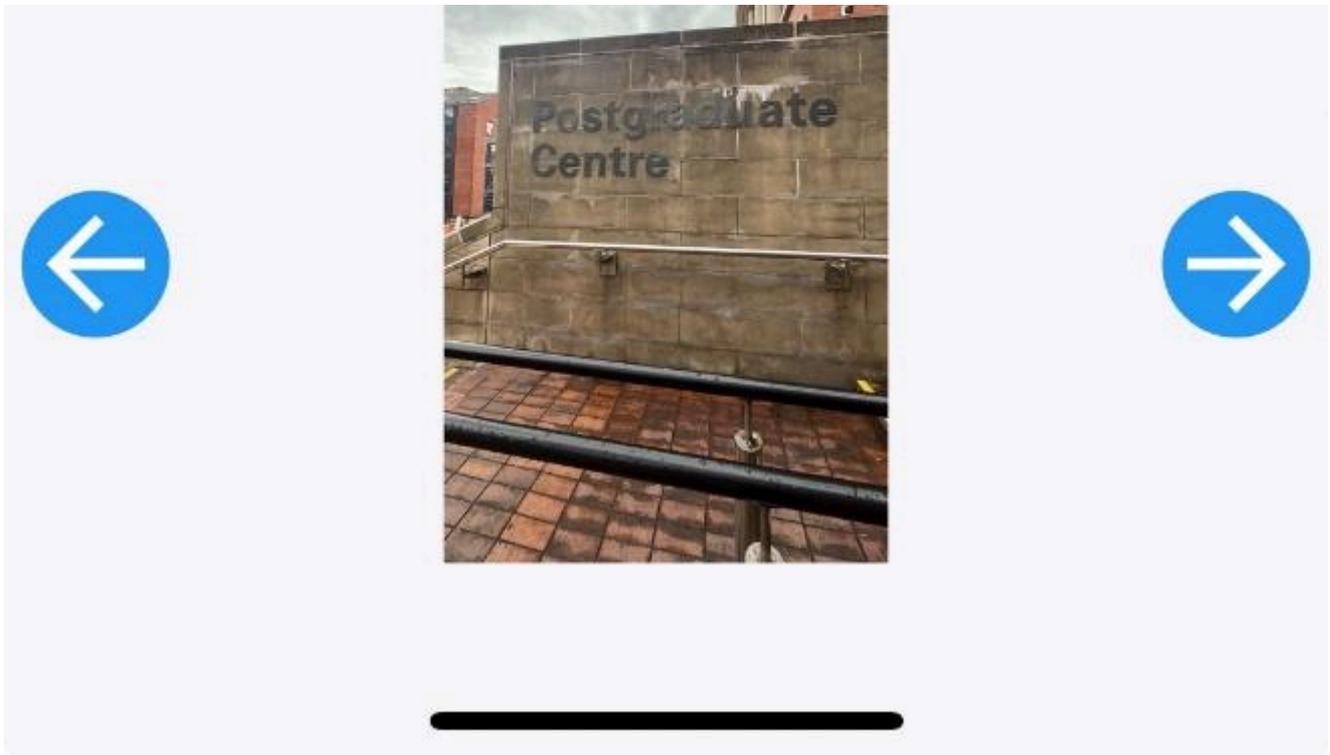
Figure 7. Playback mode of a mobile map previously collected with the QualNotes App.

Conclusion

We have introduced an open source collaborative app, utilizing modern frameworks such as Flutter and Firebase for scalability. The app has two primary goals: enabling digital data collection and serving educational purposes. In this Blueprint, we have provided a step-by-step guide for standalone users and demonstrated how some of its functions can be integrated into classroom and field-based teaching exercises.

Our aim has been to develop a mobile application that streamlines the process of collecting qualitative data while leveraging the digital devices we already carry. To this effect, one user noted: "It makes data collection so much more efficient and simple, as well as manageable when it is time to process and analyze the data." This feedback underscores the app's ability to enhance productivity and ease of use.

We believe the app's collaboration feature is a significant pedagogical tool, both in the classroom and in research settings. In the classroom, it provides students with a tactile and interactive means to engage in the learning process, allowing them to touch the screens of their own phones, type questions, and drag and reorder other questions. The haptic nature of teaching with QualNotes brings the learning experience directly into the students' hands, creating an embodied experience of learning methods that have traditionally been taught through textbooks and standard lecture formats.

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