# Global MedAid – evolution of an mlearning app for international work-based learners


| Jo Colley | Claire Bradley | Geoff Stead | Jessica Wakelin |
|---|---|---|---|
| Tribal Group | Tribal Group | Tribal Group | Tribal Group |
| Cambridge, UK | Cambridge, UK | Cambridge, UK | Cambridge, UK |
| colley.jo@gmail.com | clairebradley01@gmail.com | Geoff.Stead@tribalgroup.com | Jessica.Wakelin@tribalgroup.com |



**ABSTRACT**

This paper outlines an ambitious global mlearning solution called 'Global MedAid', which aims to provide learning resources and tools for personnel in disaster or emergency situations. It outlines the development process and, in doing so, presents the design considerations and solutions for developing a cross-platform application, which combines a wide range of media types for web-based, online and off-line use. The resulting prototype application combines elements of mlearning alongside appropriate tools for use by field workers and personnel with a variety of roles and shows how partners and users have been involved in the design process.



**Author Keywords**

work-based learning, defense, mlearning, training, deployment, support tools, productivity tools, smartphones


**INTRODUCTION**

Over the last two years, there has been a sharp increase globally in the number of mobile phones in use. The ITU annual report shows that there are now nearly 6 billion mobile-cellular subscriptions worldwide (International Telecommunication Union, 2011). In parallel, there has also been an increase in the uptake of smartphones: phones which combine the functions of a personal digital assistant, a mobile phone, a mobile media player and a camera. In 2011 over 85% of new handsets were able to access the mobile Web. In many parts of the world, smartphones are on the way to replacing laptops and other computers, and have become, for many people working in the northern hemisphere, an indispensible personal and working aid. In the developing world, the mobile has become an essential survival tool, such as providing the ability to receive vital weather forecasts and allowing users to bank remotely (for examples, see Kiwanja.net http://www.kiwanja.net/projects.htm). Health care has also been supported via mobile in a variety of ways, including using the short messaging service (sms) for reminders about medication (see for example WelTelKenya, reported in the Lancet http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(10)61997-6/abstract).

From an educational perspective it is now accepted that mobile devices have a number of important characteristics which make them attractive, including increasing portability, functionality, multimedia convergence, ubiquity, personal ownership, social interactivity, context sensitivity, location awareness, connectivity and personalisation (Pachler et al, 2010). Educationalists and trainers are thus considering ways in which the devices and applications can provide learning resources and tools that are available in the learner's pocket for timely use, an aspect proposed by Wishart and Green (2009). Furthermore, in this collection of concepts and cases of mobile learning in work environments, there are numerous examples of how mobile devices foster situated approaches to learning in and across work contexts (Pachler et al., 2011). However the notion of mobility relates not just to physical mobility (of the device or the user), but the opportunity to overcome physical constraints by having access to people and digital learning resources, regardless of place and time (Kukulska-Hulme, 2010).

It was within this context that the MoLE (Mobile Learning Environment) project was funded, a multinational technology research project sponsored by the U.S. military as part of its Coalition Warfare Program, which takes a multidimensional approach to fostering cooperative projects that enhance interoperability between U.S. forces and coalition partners worldwide. The emphasis was on solutions that would offer combatant commanders the capabilities of portability and field-ability in developing solutions that are applicable to multiple combatant commands and that will reach warfighters quickly.

The project has involved participants from up to 24 nations globally, and aimed to investigate whether the utility of mobile technologies could be harnessed to prepare personnel for a disaster or emergency situation, and provide a useful resource during an actual event. The main goal was to leverage mobile technologies and the global telecommunications infrastructure to facilitate the sharing of knowledge and resources between the partners across the world.

**BACKGROUND RESEARCH**

Tribal's role in the project was as technical expert. As a leading developer of mobile learning content, the goal was to develop innovative technical and training solutions to meet the challenges of meeting the needs of a diverse range of both contexts and personnel. Embarking on such a global solution required much up-front research, mainly because there was no existing research that had sufficient global reach and focused on all of the domain areas required. Thus, the first stage in the development process was to conduct background research into the current mobile situation globally, for example,

which devices were being used across the world, which mobile companies were involved and what was their reach within the participating counties, the socio- and economic impact of mobile phones and wireless internet across the developing world, what were people using their phones and/or other devices to do, what were the issues globally? The project also considered the needs of this diverse range of users across the world, with a view to determining the types of content and tools that would be required to meet the aims of the project and the funder's requirements.

The research also uncovered several critical reports and reference sites (see for example W3C: Mobile Web for Social Development Roadmap : http://www.w3.org/TR/mw4d-roadmap/) that proved crucial to the ongoing project, for example on global mobile statistics and mobile usage. These were integrated into a project report that collected all the research data gathered. Highlights of this research, and links to key sources are available on the MoLE project website (see www.mole-project.net/research).

### App Research

In addition to the desk research outlined above, hundreds of mobile medical and productivity apps (applications) were evaluated and compared to build baseline data about the potential core functionality that would be required, and also to compare design features and usability aspects. The majority of these mobile apps were not directly applicable to the project, but had features or functionality which were felt to be useful reference points. In summary, we found:

- very few apps that were directly relevant to the needs of Humanitarian Assistance, or Medical Stability Operations (MSO);
- many apps that provided specific productivity functions (e.g. 'to do lists');
- many apps that covered health or medical information, but very few which were of a sufficiently acceptable high quality, in that they had up-to-date or relevant content, suitable design features or desired functionality;
- many more relevant apps for the iPhone than for Android devices, and even fewer for Blackberry.

The most useful, or relevant apps were installed on demo devices, and shared with all the partners (in each nation) and key stakeholders.

### User Surveys

MoLE partners also contributed to the baseline data via three different sources:

- DMRTI (The Defense Medical Readiness Training Institute) a US-based training facility that prepares military staff for humanitarian aid missions surveyed their students on their smartphone use and its perceived appropriateness for mlearning.
- The UK Ministry of Defence surveyed a cohort of their staff, asking similar questions. These were a broader group, not especially focused on disaster relief operations.
- The partner nations taking part in the MoLE project all provided their own survey responses, which provided additional data from a potential target user group i.e. medical and military personnel, and those involved in relief operations.

Whilst the background research uncovered some useful examples of medical information and productivity tools, it confirmed that a bespoke app would need to be developed to meet the specific needs of the project. Because the potential user group was broad, covering both medical and non-medical personnel, and a range of possible missions, the content needed to be similarly broad, but still of sufficient depth to be relevant and useful. Also, the development of mobile courses that would be appropriate for the target user group was an aspect of the project that made it different from the types of commercial apps available at the time of this initial research. What the team wanted to create was a tool and an information source, combined with just-in-time mlearning that could meet the needs of this broad spectrum of users.

## MODELLING AND DESIGN OF THE APP

Making use of all the research data gathered, the core project team developed the initial proposition, and designed, via an iterative process, early prototypes of how the MoLE mlearning app might look and function. This proved to be quite complex, as the process of prototyping exposed the previously understated issue of the wide range of potential users, and therefore the difficulty in identifying single sources of content, or single functional requirements that would suit all users.

A Kick off Project meeting for partners was held in February 2011 in London. In preparation for this, the team produced a short film to assist participants and other interested parties to understand the disaster / relief scenarios the app was being created to deal with, and the typical users who would most benefit from the kinds of content and tools that were under consideration. It was used to help them think through a possible scenario and potential uses of mobile technologies, and to come up with suggestions and ideas for both content and exploiting the affordances of mobile devices, appropriate to a broad context of use. The meeting was attended by partner nations including a range of personnel with military and NGO (non-governmental organisations) backgrounds, many of whom had experience of deployment in austere situations. During the workshop, delegates worked in groups to suggest possible types of content and mobile solutions for the different stages in a mission.

The project funders were especially interested in how technologies and information could be shared between the multiple stakeholders in an emergency relief situation, which would include both military and civilian workforces from several nations. They wanted the app to offer mobile learning tools and techniques to help improve their preparation and productivity on the job. It was thus important that the app represented the three very distinct stages of activity for MSO (Medical Stability Operations) workers: preparation before they go on a mission, refresher info en route, and job aids for when they get there. Typical content needed to include:

- compliance training (compulsory courses that need to be taken pre-mission)
- information (generic information about countries, disaster relief and medical emergencies and more specific information relating to disasters)
- inventory management and logistical information
- practical solutions to problems (staff protection and safety, delivering medical care, working with partners, working with the local population).

The meeting was thus instrumental in helping to frame possible areas of content the app should contain and the types of content that could be realised for mobile devices.

**Development of the content and menu design**

One of the content development challenges was for the app to demonstrate the ability of a mobile device to provide a range of users with quick and efficient access to useful and relevant materials. This needed to be available in a variety of contexts, including the more challenging scenarios of disaster relief. The smartphone has many integral functions that could be exploited in a range of circumstances, and its growing ubiquity meant that few barriers to its broad usability were anticipated. Context and location-aware materials (for example making use of GPS) bring many benefits to mobile applications, particularly to users out in the field (Smith et al., 2011). Similarly, the already understood acceptance that the mobile phone, and even more so the smartphone, has blurred the barriers between work and play, and formal/informal approaches to learning and training, was also a plus in the choice of both content and design (Cook et al, 2006).

A key issue was that of size: adapting heavy courses or reference material for use on a mobile device requires skill and ingenuity, and a clear understanding of what is, and is not, possible and desirable. Some of these design issues are discussed in Parsons et al. (2007) and Bradley et al. (2009). A recent development in the massive improvement in the quality of 'e-readers' for smartphones, enabled the team to see the advantages of including manuals such as the Sphere Handbook into the app. At the other end of the scale, the ability to adapt and enhance paper-based checklists was an opportunity to play to the strengths of both the smartphone and what was felt to be the user's familiarity with app-type resources: easily accessed and simple to use, and available at the press of a button. A further challenge was that of connectivity: there was a need to provide within the app itself sufficient resources (without overloading the device) that could function off-line, in areas of no connectivity. At the same time, the content team had to consider the usefulness of being able to record and then share information with others, when connectivity is available.

The original planning and design exercise was expanded, in response to several opportunities which arose to do more active content capture and conversion, including:

- Video interviews with key MSO (Medical Stability Operations) thinkers: this provided a direct human interface/portal to dense informational texts such as the 'NGO Guide'.
- Conversion of elearning courses in Combating Trafficking in Persons (CTIP): this allowed for experimentation in converting elearning materials into an mlearning format, and in particular making best use of the affordances of the mobile device and adapting content for the smaller screen.

A limited amount of existing resources contributed by partners were repurposed and enhanced, and other sources were used to create a series of engaging and useful activities. The design challenge was to mesh together the mobile aspects of a just-in-time, just enough, easily accessible and appropriate for context, resource, with some of the more traditional mlearning elements, and also include a mechanism for getting user evaluation on the app. Technical and design aspects in relation to screen size, mobile affordances and navigation were also factored into the process. The affordances of both mlearning resources and the apps that were researched, were all taken into account in both the planning and the development of the activities that went into the app. For a wider discussion of some of the design challenges involved in developing the app see Towards Open Formats for Mobile Learning (Stead, 2012).

**First version of the app**

The above discussions and partner contributions led to the development of the first version of the app which was structured around the three stages of deployment: get ready, en route and on the ground (see Figure 1). Each of these three stages contained content that had been supplied by partners and adapted by the content team, or developed independently by them. Each deployment phase had content that was appropriate for each phase, and categorised as learning materials, checklists and reference materials, as follows:

- **Get ready**: contained a training course *Combating Trafficking in Persons* which had been adapted from a mandatory elearning course, which all DoD (United States Department of Defense) and other deploying personnel are required to

complete, and a series of checklists, adapted from paper-based lists supplied to deploying personnel by the United States military, to help with packing and pre-deployment essentials.

- **En route**: checklists, for example for a nuclear radiation scenario, learning materials that help personnel recognise NGO logos, and video-based reference materials (a discussion about the issues arising when military and NGO personnel work together in a disaster scenario).
- **On the ground**: this section only contained reference materials, such as relevant documents on ethical topics.

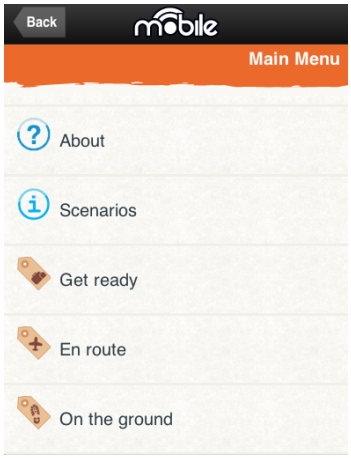


**Figure 1. The MoLE App menu screen in Version 1**

Technically, the app was authored as an open, extensible mobile learning capability that includes:

- Cross platform performance: an extensible Mobile Application Layer supports mobile learning content on both Apple and Android devices.
- Multiple contexts of use: media and learning resources are drawn from multiple partners, and designed for various contexts of use, e.g. for reference, as a course, as performance support, as an 'on-the-job' aid.
- Integration with traditional architectures: usage tracking and evidence from the app's use is saved to a traditional learning management system (LMS).

For more details of the technical considerations taken into account see the project report Cross-platform Mobile Development (Hartmann et al., 2011).

Some examples from the mlearning course for 'Combating Trafficking in Persons' are shown below in Figure 2.

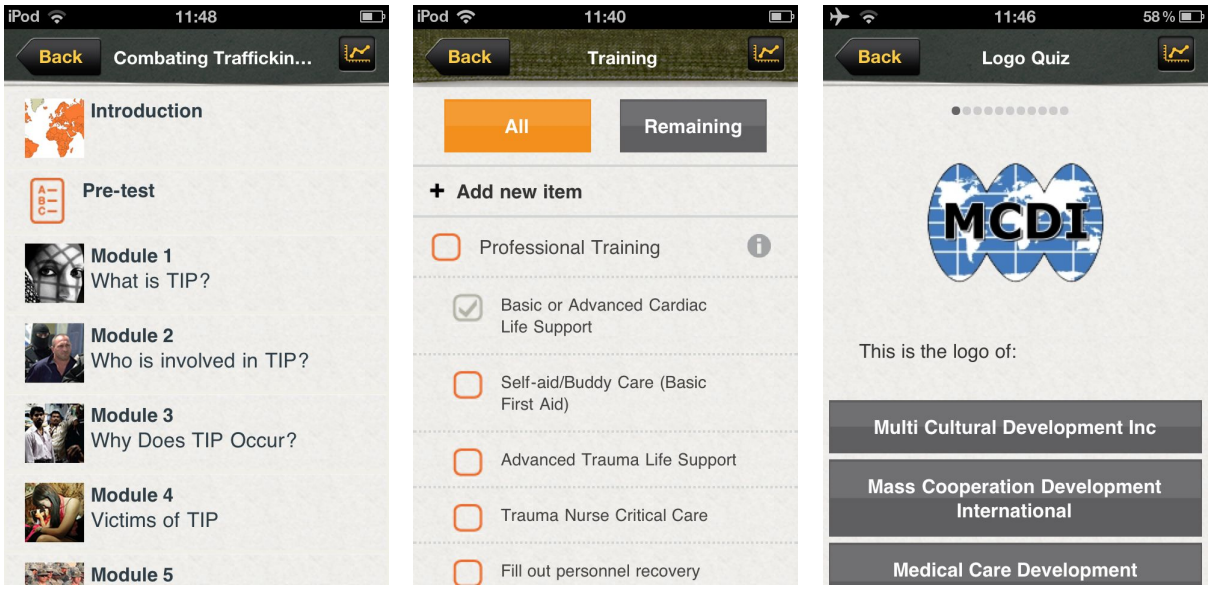


**Figure 2: Examples of content screens**

## VERSION 1 USABILITY REVIEWS

Once the first version of the app had been authored and the content created, Tribal followed its internal process protocol of iterative usability reviews with untrained reviewers to evaluate and refine the user experience. This process assists in

the identification of any key usability, technical or practical issues in advance of the wide-scale Proof of Concept trialling scheduled from April 2012.

Based on good practice recommendations from Nielsen (Nielsen, 2000), five end-users with military and non-military backgrounds were selected. Each was presented with a sample disaster scenario, and asked to step through the app in the role of a specified member of the team. Whilst the tasks were unlikely to be seen as 'realistic', the aim was to help the user engage with the app so that they could give feedback on navigation, ease of use and suitability of the content. The content in the app at this stage was oriented to US military personnel and NGOs who work alongside US military (including the Combating Trafficking in Persons compliance course) but nevertheless approximated the kind of reference materials and productivity tools likely to be of use to military personnel and other groups in similar circumstances.

In terms of the suitability of the mobile app and its content, the response from the five users was generally positive, with comments such as:

> "The Tip course is a useful way to get the information across." (User 1)
>
> "The content is pretty intuitive." (User 2)
>
> "Checklists are a good thing to have: even better if you could add your own." (User 1)

The main result from the testing however, was that the arrangement of the content into deployment phases was not felt to be intuitive, and consequently the menu was redesigned into categories (see Figure 3). This is also in line with current views about mobility and content, as summed up by Traxler, "mobile devices demolish the need to tie the particular activities to particular places or particular time" (Traxler 2011). Changes were also made to navigation and functionality, and a search facility was added to the Library section, which had also been suggested by the testing group.


**Figure 3: The revised Global MedAid App menu screen**

## NEW CONTENT

The redesign of the menu and app structure opened up more possibilities for content, e.g., the University of Miami provided instructional videos for treating trauma injuries (see Figure 2). The availability of these short, focussed resources for users is very valuable, but installing them all within the app can easily overload the device. The compromise position reached was to provide some videos within the app and provide a link to further ones when a connection opportunity arose. The NGO guide was added as an e-book, along with the Sphere Guide. It was still felt that more use should be made of the collaborative possibilities of the device itself, and first versions of a 'network' section with a collaborative yellow pages was developed, for personnel to use and share information about organisations in specific areas. This more collaborative aspect of the app, and further uses of the functions of the phone, such as camera, audio etc. need further development in future versions of the app. As the latest Horizon Report says, "the best apps are tightly integrated with the capabilities of the device itself, using location data, motion detection, gestures, access to social networks, and web search, to seamlessly create a full-featured experience" (NMC Horizon Report Higher Ed Edition, 2012).

## EVALUATION

The testing of Version 1 of the app resulted in amendments, as discussed above, and the creation of a 'Proof of Concept' (PoC), to be evaluated across the partnership from April to June 2012. The evaluation was designed to allow the MoLE Project to get feedback from target users, including personnel from military and non-military backgrounds, some of whom have a medical background. The aims were to test the effectiveness of the tool that has been developed, and in

particular how capable mobile learning technology is of addressing the emerging requirement to provide training and performance support tools in austere circumstances.

One particularly challenging aspect of the evaluation was the very diverse nature of the participants: geographically, culturally and professionally. A volunteer could be using one of over 20 different supported smartphones, from one of over 20 nations. Trials spanned from outdoor training sessions in South Africa, to University based trials in Georgia, to the Fire and Rescue service in Germany. To ensure maximum ease of data collection, the collation of evaluation data was done entirely on the smartphone, as an integral part of the Global MedAid app. The evaluation process used a mixed-method approach designed to produce both quantitative and qualitative data (Punch, 2009), by collecting a blend of formal evaluation questions and informal tracking data as participants used the app.

Participants completed an online demographic questionnaire before being guided to install the Global MedAid app from their local app store, using a provided pin code to access it. This gave them access to the full app, and all content. In addition, an "evaluation" button was available on all screens, to launch the evaluation layer (survey). This survey guided each user through a series of tasks in the app, taking them through envisaged steps of deployment, and to those parts of the app which would be appropriate and useful at each stage. For example, the participant was asked to navigate to Mission Tools, look at a preparatory checklist, and to add an item of their own choice which they considered to be of use. After each task, they were then asked a series of questions designed to provide quantitative data, which focus on the self-efficacy, utility, usefulness and accessibility of the app. Qualitative data was sought through free text questions in which they were asked to relate their experience of using the app, and say what they liked and didn't like about it. In addition to the formal evaluation questions, user activity in the app was tracked, and data collected to correlate against their answers. The evaluation questions were available in multiple languages, to suit individual nations.

Participants in the PoC were guided by local coordinators from each nation who had taken part in a preparatory workshop held in the UK and had access to supporting materials, such as "how-to" guides, and an introductory video to share with delegates. These resources are available on the project website at http://www.mole-project.net/evaluation/intro

**Initial evaluation findings**

Project partners are in the process of analysing all the data and producing a full evaluation report, but some of the initial findings are presented here, to illustrate how the users found the app.

*The users*

24 countries[1] initially volunteered to participate in the PoC, but only 21 took part in the evaluation. 268 people took an initial demographic survey then installed, and used the app. Of those, 177 people started the evaluation and 137 completed it. The majority of those who started were males (67.5%), many over 30 years old (78%). Their areas of professional expertise were as follows: 34% medical, 26% elearning, 11% training, 1% rescue, and 25% 'other' (2% didn't answer the question). Only 29% had previously been involved in humanitarian assistance or disaster relief operations, and 17% had taken the CTIP course as an e-learning course in the preceding 2 years. In terms of their technology choices 63% were using an iPhone (37% an Android phone), and the majority (71%), were using their own, personal phone (29% were borrowing one for the trial). They were asked to rate the question 'How comfortable are you with using the mobile device that's running the MoLE app?' on a 7-point Likert scale, with 1 being low (beginner) and 7 high (advanced user). The mean score was 3.99, but 38% rated 1-3, 14% rated 4 and 47% rated 5-7, so more users were comfortable using their device than those who were not. As you might expect, those using their own device were more comfortable with using it, with a mean rating of 4.35 compared to 3.15 for those using a loaned device. Looking at the tracking data generated from use of the app, users accessed it on average 9.83 times, but one user accessed it 79 times.

*Initial analysis of the results*

The full evaluation of the trial is still in progress, and seeks to understand the self-efficacy, utility, usefulness and accessibility (usability) of the app by correlating answers to a range of questions with observed behaviours from participants. Most of these questions used the same 7-point Likert scale used in the demographic questionnaire, with 1 being low and 7 high. Participants were asked to use all the core sections of the app, during the 3 simulated stages of their deployment, enabling the collection of their views across the many different content types, and tools. These included structured courses (Tip), video interviews, reference guides, eBooks, checklists and other productivity tools.

To provide more meaningful qualitative feedback, they were asked to answer this question: 'Please write up to five single words which best describe your overall experience of using the mobile device as a tool for learning'. Some wrote a phrase rather than five descriptive words, but the results are displayed in the Word Cloud below. The larger the font size, the more common the word.

[1] The countries involved were: Azerbaijan, Belgium, Bulgaria, Canada, Chile, Egypt , France, Georgia,, Germany, Italy, Jordan, Mexico , Nigeria, Norway, Peru, Poland, Romania, Serbia, Singapore, South Africa, Switzerland, UK, Ukraine, USA.


**Figure 4: The words users used to describe their overall experience of using the mobile device as a tool for learning**

105 participants responded to this question. The most commonly used descriptive word was that it was "interesting" (23 times), followed by "easy" (19), "useful" (17), "easy to use" (10), "convenient" (9), "simple" (9), "informative" (9), "fun" (8), "accessible" (6), and "fast" (6). Another 5 responses said it was "speedy" and "practical", and 4 described it as "efficient", "flexible" "friendly", "good" and "mobile". The only negative comments made three or more times was that it was "challenging" (3 users) and "frustrating" (3). Very few responses were wholly negative (4 out of 105) – most users balanced negative points with positive ones.

*Discussion*

Overall the users have given a very positive response to the app, across all the sections. The responses relating to the questions on utility show that a high proportion of users found that mobile devices were useful for providing this type of training, which is also reflected in 17 users using the word "useful" in the free text question. Other comments made were that the app is "practical', "convenient", "handy" and "flexible", these last three all being characteristics usually associated with mobile learning applications. Usefulness is not discussed here, as it was mainly being measured by some of the transparent data collected through use of the app, which has not been presented in this paper.

In terms of self-efficacy, the majority of users found the content within the app to be effective. The word "interesting" occurred 23 times, with 8 users saying that it was "fun" and 3 "educational" and "engaging". Such opinions are obviously important in securing user motivation to use, and continuously use an app. Other comments were that it was "informative", "simple", "effective" and "good".

Accessibility (or usability) saw more mixed reactions. There are clearly some accessibility issues that need to be considered for further development of the app. Some users had issues with the navigation, saying that it was "poor" or "hard", or that it was "confusing" and "unintuitive", and some commented that "the screen was too small". But in reality the number of users who made these comments was low (2 or less). These comments should be looked into in more detail to see if these users were disadvantaged in any way, for example by using a loaned and unfamiliar device. Conversely, more users said it was "easy to use", "accessible", "fast" and "friendly", so the majority of users did not have accessibility issues.

## CONCLUSION

The MoLE project and the development of the Proof of Concept of the Global MedAid app has been a major undertaking, involving the collaboration of many nations working together to establish resources that can help those who venture into difficult environments in a variety of roles. The project has created a technical approach to delivering this ambitious set of resources for on-line and off-line access and whilst it has not yet been tested 'out in the field', the app and its contents have been well-received by those who have used it. Participants seemed to appreciate the full range of media, and interactivity types, from structured training courses to more immediate reference tools. Clearly, a full statistical analysis of the individual quantitative questions with a full analysis of the qualitative data needs to be undertaken, and at the time of writing this is in progress. However, based on this initial analysis of the results from evaluating the app, a number of conclusions can be drawn. The users thought that having this type of training available on mobile devices is useful, finding the app "convenient", "handy" and "flexible". This goes some way to justifying the original proposition: that mobile access to on-the-job learning and support materials is an effective and efficient way to support professionals working in medical and stability operations. Not only was the app considered to be useful, but it was also effective, and even "interesting", "fun" and "practical". The majority of users also found the app to be accessible and usable, for example it was "easy to use", "fast" and "friendly", although a small number experienced some issues with navigation (which needs looking into further) and the small screen of the mobile device.

Further testing will be carried out in 2013, using a refined version of the app, to include a new Network section and reworked Library. It is anticipated that the app will be trialled by personnel on a deployment-style exercise, carried out by US military personnel and others. Future iterations of the app will allow professionals to add or adapt content for specific circumstances.

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