What we can learn from the iReflect project: Developing a mobile app for reflection in work-integrated learning

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Reflection for learning is a common course requirement for many WIL subjects and when students are engaged in blended or online modes of delivery or in off-campus placements, reflective practice needs to be supported. It also needs to be better integrated with mobile technology. This paper reviews the three cycles of the iReflect project which aimed to address these needs by developing a mobile reflection app. The project was framed by an integrated theoretical approach that combined participatory action research (PAR), distributed leadership and agile development. A mixed method approach was adopted to collect data from literature reviews, student focus groups, surveys and research notes. A focus on the pedagogical, technological and institutional dimensions of the WIL ecology provides new insights into student use and perceptions of mobile technology. One key outcome is the identification of nine new user stories demonstrating the mobile technology needs of reflective WIL students and teachers.

Keywords: Work-integrated learning, reflective practice, apps, mobile learning

Reflective practice is becoming a mainstream mode of learning and assessment, particularly in tertiary curricula supporting work-integrated learning (WIL). Students are encouraged to use reflective practice to support transformative and deep learning (Boud, Keogh, & Walker, 1985; Mezirow, 1991), making sense of, and learning from, their experiences. The most common mode of reflection for learning is text based (Coulson & Harvey, 2013; Clarke & Burgess, 2009), although other creative approaches are also being incorporated and scaffolded in WIL (Harvey, Walkerden, et al., 2016).

Scaffolding and supporting reflective practice can present challenges when WIL students are engaged in blended or online modes of delivery, in off-campus placements or in remote areas that lack internet access. As a result, a need for a mobile app was identified, preferably integrated with an e-portfolio platform and institutional learning management system, that could be used by students to practice and document reflection for learning both on and off-line.

This paper documents the journey of the iReflect project which was initiated in response to these needs. The research was designed using an integrated theoretical approach combining participatory action research (PAR), distributed leadership, and agile development, while adopting a mixed method approach to data collection: literature reviews, student focus groups, student and staff surveys and research notes.

The structure of this paper embeds the PAR approach - to invite the reader to follow the research journey through the lessons learned and issues yet to be solved. An ecological framework allows for a focus on the pedagogical, technological and institutional dimensions of the ecology of WIL. One key

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outcome of this research is the nine new user stories about the mobile technology needs of reflective WIL practitioners (both students and teachers).

AN ECOLOGICAL FRAMEWORK

Learning through WIL is a complex concept and experience. When considering the role of reflection for learning in this, a myriad of diverse influencing factors need to be identified together with the contexts, or ecologies, in which they are located. For example, it may be "situated" (Lave & Wenger, 1991) in a physical or cyber classroom, but often in contexts away from the university, including experiences with host organisations through community, industry or institutional placements. Across these contexts are multiple participants with various interdependencies: the learners, academic and professional university staff, host supervisors and community partners.

An ecological approach offers a structure to systematically investigate the many components of learning through WIL. Ecology is conceptualised as a holistic and systems approach (e.g. after Bronfenbrenner, 1979; Buttel, 1986; Hawley, 1950; Lewin, 1935), with an emphasis on the bidirectional interrelationships between and across systems, and between and across people and their environments. Likewise, in researching the integration of technology, or the mobilisation of reflection, learners are central to this ecology, interdependent and interconnected with university staff; host supervisors; personnel of community organisations; disciplinary and institutional policies; technology; and broader societal dimensions. The three main ecological dimensions, which are the focus of the research, are that of pedagogical, technological and institutional as shown in Figure 1.

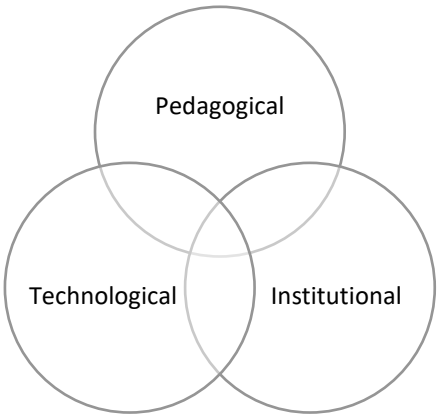

FIGURE 1: Three ecological dimensions researched by the iReflect project.

Institutional Dimension

The context for this research is one large metropolitan university that introduced its signature WIL program in 2011, inclusive of different forms such as internships, service learning and cooperative education. WIL subjects are embedded in all undergraduate degree programs with a requirement to include "mechanisms through which students can reflect, document, evaluate and/or critically analyse what they have learned over the course of the [practical] activity..." (Macquarie University, 2015). Concurrently, students develop problem solving, critical thinking and self-efficacy, all of which require higher order thinking skills that are aligned with reflection (Harvey, Coulson, & McMaugh, 2016). It was recognised that students were also learning off-campus through distant and online delivery modes, and sometimes in remote areas lacking internet access. The institutional challenge then was how to support, even scaffold, student reflective practice given diverse student and placement contexts.

To address this challenge, the research team for the iReflect project formed a multi-disciplinary community of practice (CoP) focusing on mobile technology. A key aim was to develop an app that could be used by students to practice and document reflection for learning, both on and off-line and preferably integrated with an e-portfolio platform and institutional learning management system. Monthly action learning circles provided a space to reflect collaboratively, to experiment, create and learn. Participants included pedagogical and institutional leaders of WIL, industry and scholarly partners and student representatives.

This scholarly work raised research questions. Namely, what are the:

> 1) perspectives and practices of WIL students and staff in relation to using apps to scaffold and document reflective practice?
>
> 2) user stories depicting mobile technology needs of reflective practitioners (both students and staff)?
>
> 3) ways students use a mobile app for reflection for learning?

Pedagogical Dimension

The widespread adoption of reflective practice has been well documented in relation to specific professions (e.g., health and medical, teacher education, and social work), and increasingly, WIL more broadly. Text-based documentation of reflective practice is the most common mode of reflection (Clarke & Burgess, 2009) and learning is heightened if student and teacher reflective practice is scaffolded (Coulson & Harvey, 2013). Extending from this has been an exploration of the diverse ways in which students practice reflection – driven by disruptions to traditional methods, individual circumstances and needs (including remoteness), contextual learning styles and preferences (Harvey, Walkerden, et al., 2016; Harvey et al., 2014). This diversity, and the process through which students identify and adopt methods to reflection for learning, is evidenced through data (WIL students' online reflections) from multiple WIL subjects across the university. Examples of their insights into reflective practice include: "I found I had to reflect upon the reflection process itself in order to identify a solution" (Undergraduate student 4, 2016) and "my deeper appreciation for…[the professional context] is thanks to… a "mindfulness" of one's own experiences and knowledge and how these experiences can build on one's learning" (Undergraduate student 12, 2016). Students also recognised a need for diverse approaches to practice with comments such as "I adopted a variety of reflective practices including journal writing, creating a list of successes and challenges, goals to improve on and speaking to people at work" (Undergraduate student 28, 2016) and "I love how everyone interprets and applies reflection differently on a personal level and then within their specific discipline as well." (Undergraduate student 20, 2016).

Acknowledging this diversity represented additional consideration: whatever tool was to be devised it needed to align and fit with individual contexts, while enabling reflection for learning. Reflection being conceptualised as the "deliberate and conscientious process that employs a person's cognitive, emotional and somatic capacities to mindfully contemplate on past, present or future (intended or planned) actions in order to learn, better understand and potentially improve future actions" (Harvey, Coulson, et al., 2016, p. 9).

Technological Dimension

Since World War II technological developments have been driven by, amongst other things, exponential increases in the performance of the underlying hardware - an empirical pattern described by Moore's Law: that "the number of components per chip was roughly doubling every year" (Mack 2011, p. 202). In response, the most widely used computing platform has changed from mainframes, to minicomputers, to personal computers, to smartphones. The dominant uses of computers have expanded from the institutional, to the professional, to the intimately personal. In developed economies, smartphone ownership is now pervasive amongst younger adults: 92% for 18 to 29 year olds, in the U.S.A. (Pew Research Center, 2017), and 94% for 18 to 24 year olds in Australia (Deloitte, 2016).

This shift to pervasive access to mobile computing both provides opportunities for, and makes demands on, WIL educators' efforts to support and scaffold reflective practice. An opportunity to support reflection for learning in ways that are convenient for learners and those who work with them is obvious: mobile devices are used extensively for messaging, blogging, note taking, and casual photography.

Mobile learning has been described as "anywhere, anytime" learning that is not fixed in time or space and that is supported by digital technologies (Kanis, Brinkman, & Perry, 2009; Poore, 2016;). It can support a range of pedagogies, many constructivist in nature (Poore, 2016), including reflection for learning. Between 2013 and 2015, student use of mobile technologies for learning has increased by 40 percent (McGraw-Hill Education, 2015). On mobile devices, there is one major design choice to address: using apps or a web browser. For use offline, apps are necessary and in Australia, they were preferred for social networking by 79% of users (Deloitte, 2016); social networking is at least resonant of reflection. There are good reasons to develop an app to support and scaffold reflection: "[a]pps tend to be most successful for processes or tasks which are completed regularly" (Deloitte, 2016, p. 66, cf. p. 25).

While identified as a 'technology to watch' (Johnson, et al. 2013), research focusing on the role of mobile apps in supporting learning, and reflection for learning, is limited. Others chose not to use apps, but have students set multiple daily reminders on their smartphones as reflective prompts to practice mindfulness (a skill related to reflective ability), (Hadar & Ergas, 2019). The general view is that they can provide support for learning that is economic, flexible and portable; they break down the barriers of physical location, time and user, and can record videos for later reflection by teachers (Aubusson, Schuck & Burden, 2009). One study, focused on using the Evernote app for reflection, concluded that use was "very modest" (Schepman, Rodway, Beattie & Lambert, 2012) and students were more likely to record passing ideas and thoughts, for more in-depth reflections later.

A review of currently available apps identified only one that directly supports reflection for learning: the "R app" developed by and, designed for use inside the Maastricht University network. While it allows capturing of data in several modes, it does not have functions such as offline usability, drawing, uploading to a database. Johnson et al. (2013, p. 7) have reported that mobile apps to support reflection for learning "enable learners to share their questions or findings with each other in real-time...leverag[ing] the cameras, microphones, and other tools. This is especially convenient for work done outside of the classroom…" (on- and off- campus).

Literature, however, suggests that there is a disconnect, or gap, between students and their universities when it comes to use of this technology. While students are using smart mobile technologies to support their learning (Murphy, Farley, & Koronios, 2013) there is evidence of some reticence, or restriction, in

higher educational institutions and their 'use of new, innovative technologies' (Marinagi, Skourlas & Belsis, 2013). The same has been reported about reflection for learning (Anderson and Herr, 1999). One approach, suggested to bridge this gap, is to create learning environments that support students using their own devices - 'student-led technology provision' (Gosper, Malfroy, & McKenzie, 2013, p. 279). Extending this argument to reflection, well-designed mobile apps could provide students with direction over learning, as they control their practice in their own time and in their own way (Poore, 2016).

THEORETICAL APPROACH

An integrated theoretical approach was designed that aligned with, and supported research into, the ecological dimensions of the institution, pedagogy and technology. Participatory action research (PAR) was integrated with distributed leadership and agile development - each have been successfully applied to learning and teaching projects in higher education. Participatory action research (PAR) (Kemmis, McTaggart, & Nixon, 2014) provided for collegiality, building in both research and evaluation, and a flexibility, or agility, to adapt as project requirements shift (Harvey, 2013). This flexibility also aligned with the Agile Development approach (O'Sheedy, 2014) adopted to address the technology dimension. All project participants brought strengths to the research (Harvey, 2014) and were enabled as leaders of learning and teaching through a distributed model of leadership, an approach that increases the sustainability of project outcomes and leadership capacity (Jones & Harvey, 2017).

METHODOLOGY

From the start we acted to "build in research and evaluation" (Wadsworth, 2010) into our experimental design. Participatory action research (PAR) was the methodology – its iterative cycles of plan, act, observe and reflect, providing a research structure while ensuring reflection was not only the focus, but was practiced as part of the research process as well. Human ethics approval was received for this research (approval no. 5201200211).

Mixed methods (Creswell & Plano Clark, 2011) were adopted for data collection (Table 1) and analysis, to ensure synergies and triangulation of quantitative and qualitative data. Methods ranged from focus groups to surveys, user stories, and student and project team reflective texts. Three main PAR cycles ensued – linked to each of the research questions and explained further below.

DISCUSSION OF FINDINGS

This section of the paper reports the findings for each PAR cycle in terms of lessons learned and in relation to the three ecological dimensions.

PAR Cycle 1: Reflection Perspectives and Practices

The first research question was the focus of PAR cycle 1, that is, what are the perspectives and practices of WIL students and staff in relation to using apps to scaffold and document reflective practice? Data were collected through a student focus group, an online survey to students and staff, and project team research and reflection.

TABLE 1: Summary of data collection and analysis methods.

Method	Detail
Student focus group	One semi-structured student focus group (n= 5) facilitated by an undergraduate student researcher. Transcription of discussions analysed via thematic content analysis.
Student and staff survey	Student (n=81) and staff (n=16) quantitative and qualitative responses. Quantitative data analysed using descriptive statistics, that is, frequency reported as percentages. Qualitative text analysed via thematic content analysis.
Student feedback	Student feedback on the role of reflection in WIL subjects studied (n=103). Student reflective text analysed via thematic content analysis.
User stories	Multi-disciplinary, cross-faculty development of nine user stories. Two agile workshops with key stakeholders (project team and colleagues leading the design and delivery of online reflection: n=13, student representatives: n=3) collating use by student and teacher perspectives. Collaborative synthesis into user stories.
Research team collaborative reflections	Monthly reflection on each PAR cycle documented as notes. Reflective notes analysed via thematic content analysis.

Lessons learned - the pedagogical dimension

A student focus group was facilitated around seven semi-structured questions and through engaging participants in a range of reflective activities. As a result, it was discovered that most students had been actively practicing reflection without realising until attending the focus group. Students in general held positive thoughts and feelings towards reflection: "Without reflection, you are just going through the process without digesting what you have learnt" (Undergraduate student 1, 2014). They shared a belief that through reflective practice they could relearn things from past experience that they had missed or were not aware of before - the power to transform their thoughts and feelings towards a given [WIL] experience. Perceived benefits of reflective practice included that it: helped strengthen memories and enhanced understandings of various concepts; lead to better and deeper understanding of topics, and student reflections could allow lecturers and tutors to also reflect and improve upon their teaching.

Next, student (n=81) and staff (n=16) responses to the online survey on technology use and reflection (not all students answered all questions) were analysed. Almost all participants perceived themselves as confident users of technology for learning, enjoyed using technology, and largely would find an app for reflection useful (Table 2). Further, the majority were in possession of a technological device through which such an app could be used.

These results illustrate that the use of technology exhibits potential for the student learning experience; however, though the majority of surveyed students had access to mobile devices (such as smart phones), current research has found that they continue to be reliant on laptops, and do not yet perceive other mobile devices as essential to learning (McGraw-Hill Education, 2017).

TABLE 2: Student and staff responses to using technology.

	Students (*n*=66)	**Staff (*n*=16)**
Enjoy using technology	89%	88%
Are confident using technology for learning	97%	75%
Would find a reflection app useful	74%	94%
Have a smart phone	96%	94%
Have tablet access	63%	63%

An open-ended response question asked when they do, or would, use an app. Their responses (*n*=66) indicate a flexible and mobile approach to using for learning. These comments align with international research findings that reported approximately half (49%) of the undergraduate students surveyed (*n*=3,311) identify that adaptive mobile technology is very or extremely important (McGraw-Hill Education, 2016).

The students in this study reported that they could potentially use an app "whenever I had a spare moment, because my phone is always with me" (respondent 10); "…on public transport, home, office, uni…" (respondent 22); or "when I'm home or on the way home from uni reflecting back on the day and what I've learnt or can remember." (respondent 33). Other responses from students were that the app that can be used for "…educational or reflexive purposes makes it more convenient to have everything in one place, especially when writing on my phone is what I am familiar with" (respondent 47); allows me to " take notes during lectures or to make notes for reminders" (respondent 46); I can use it "…whenever I feel like recording my learning and when I want to revise" (respondent 38), "I would record how I am feeling or what I may be doing and the thought process or reasoning behind my actions." (respondent 58).

While staff were equally positive as students about enjoying technology for learning, they were less confident than students in its use (Table 2), and more enthusiastic in the potential of a reflection app. Their open-ended responses suggested that an app would support students' reflective practice and e-learning as it could cater for a variety of modes enabling thoughts, insights from significant events, emotions, and learning experiences to be captured and recorded in the app via photos, voice entries, videos, and documentation of meetings and events. This desire for diversity in the modes of reflective practice is consistent with emerging research on the need to offer diverse modes of practising and documenting reflection (Harvey, Walkerden, et al., 2016).

Lessons learned - the technological dimension

Reflecting on the feedback from students and staff, project team members identified the functionality preferences of a new reflection for learning app from the perspectives of students and teachers (Table 3).

TABLE 3: The functionality preferred by students and teachers for a reflection app.

Student preferences	Teacher preferences
1. Easy access	1. Works in iOS and Android devices
2. Activities that enable an in-depth view of the topic/area of interest being reflected upon	2. Works offline to store data to be collected in the field and when Wi-Fi is available to upload the data into the server automatically
3. Ability to store data for review any time in the future	3. Be able to populate student's cohort by uploading Excel or CSV (comma-separated values) file
4. Activities that would support (scaffold) clear interpretations of actions and tasks (reflecting on)	4. For students to be able to download the App and create a login with their university ID and/or email address
5. Interactive written reflective activities to help shy and quiet students to express thoughts freely, and to ask questions.	5. Create survey questions such multiple choice, Likert scale or open-ended questions, as seen in Survey Monkey, Qualtrics or Survey Gizmo.
6.Enable the documentation of:	6. Gather student data as CSV or Excel file to download
a. Notes	7. Ability to export 5-6 as pictures
b. Photos and annotation	
c. Audio	
d. Video	
e. Mind mapping	
f. Drawings	
7. Ability for the user to export notes via email or PDF	
8. Ability to export 2-4 to cloud storage or transfer to PC	

Developing new applications for mobile devices requires a heavy investment of both time and money, so the top 10 global companies who offer mobile platform services were contacted. The perceived advantage of this was that an app could be built quickly, and with no coding knowledge required. The outcome, however, was a stream of costs that were in excess of the project budget and this required a move into another action research cycle to explore different ways of working. What had become clear was that user needs for an app and/or e-portfolio platform should: provide reflective prompts; enable documentation as text, images, audio or drawing; be able to be used offline; provide customisable templates for reflection; engage sceptics or newcomers in the theory behind reflective practice in relevant ways; and provide user control of data management.

Lessons learned - the institutional dimension

The university had been experimenting with a mobile app prototype and the project team had hopes of building on this, however, during the first PAR cycle the development of the app was suspended. One faculty adopted a commercial portfolio and personal learning platform (for reflective practice), because they needed software quickly and they had funds. Another faculty researched student use of apps (any apps related to learning) in their WIL subjects. The project team collaborated with these teams and with a local industry developer to develop a new reflection for learning app that met the requirements for students and teachers identified by this cycle of the research. The first step of the development process was to develop User Stories.

Par Cycle 2. User Stories About Mobile Apps for Reflection

The second research question asked: "What are the user stories depicting the mobile technology needs of reflective practitioners (both students and staff)?" Building on app requirements identified in PAR cycle 1 (Table 3) to inform software design, "user stories" were developed - a technique from Agile and Extreme programming (O'Sheedy, 2014) that describes how software functions from a user's

perspective - they are agnostic with respect to the particular software environment. User stories may be described as:

> …the unit of functionality in an [extreme programming] project. […] A story should be understandable to customers and developers, testable, valuable to the customer, and small enough so that the programmers can build half a dozen in an iteration. A user story is a chunk of functionality (some people use the word feature) that is of value to the customer. It provides a simple way for developers and customers to chop up what the system needs to do so the system can be delivered in pieces. (Beck & Fowler, 2000, p. 43)

An expert in information technology (IT), provided a workshop to introduce, demonstrate and discuss the technology and the method of collecting user stories. A series of four workshops saw the project team (11 academics, 2 IT professional staff, and 3 students) build on the survey data (from PAR cycle 1) and draw on their own practitioner expertise to document multiple user stories with a focus on how the app would be used. The team used card templates (available on request) to identify, list or describe user stories (personas) as a basis for brainstorming themes. The generic structure of the template was "As a (type of student or teacher/academic) I want (to perform some task) so that I can (achieve some goal/benefit/value)", with participants filling in the information in the brackets. All user stories were collated and grouped by theme. Next for each of the resulting nine themes (e.g., recording reflections) details were documented for: the users, what the use involves, why they are doing this, and how both users and programmers can tell whether a chunk of software has successfully coded the user story.

Lessons learned - the pedagogical dimension

User stories were developed with two purposes in mind: as a platform to design software that suits users' learning needs, and as a reference point for evaluating the design of software offered by learning system vendors. The user stories are presented as a table (Table 4), where each user story is presented in a row. This design process foregrounded the pedagogical layer of the reflection ecosystem, because it took as its central concern what uses a reflective practitioner would need to maximise learning through the software.

The user stories (Table 4) provide new insights into the mobile technology needs of WIL reflective practitioners: students and teachers, and informed the development of the prototype iReflect app.

Lessons learned - research technological and institutional dimensions

As the various uses of the software were being considered in this cycle, technological elements were implicit throughout. In a similar fashion, because the assumed social context was a student's life within and following university studies, the institutional context of tertiary studies was equally identifiable.

During the design process, the institutional and technological dimensions operated on an exceptions basis - e.g. importance of linking to a Learning Management System and backing up and restoring data. As our thinking moved from user needs towards implementation, technological and institutional needs became more prominent and tightly interwoven. Design thinking was used to test learning software of two major international providers – revealing the need for substantial customisation of their software, as reflective practice was not central to the user stories their products had been designed around. This technological limitation brought major institutional constraints into focus regarding a willingness to modify software in a timely fashion, and the university's (un)willingness to fund this.

This led to working with a smaller software provider – allowing greater opportunity to embed support for reflection in the app design (PAR cycle 2).

Other issues surfaced as the design work was leveraged to advocate for better technological support for reflection. Institutionally, the tension between decentred and centralised decision making was evident - with class convenors, pedagogical support teams, information systems staff, faculties, and the university's central administration all playing into decisions about which software should be adopted, where. Processes for resolving tensions were not well developed. We used our Community of Practice (CoP) as a medium through which to explore options, however, apart from the pilot program discussed in PAR cycle 3 - the CoP acted as a facilitator, not a decision maker.

PAR Cycle 3. Ways Students Might Use A Mobile App

The third research question asked: "What are the ways students might use a mobile app for reflection for learning?" The iReflect app was piloted through a third year WIL subject, representing an opportunity to determine if it could be customised to meet user requirements as per the research findings. We were particularly interested in understanding what reflective capabilities the students wanted to use when engaging in a WIL experience, for example, note pad, audio, video and photos to enable alternative modes of reflection.

Lessons learned - the pedagogical dimension

Students (n=450) were encouraged by three subject convenors to download the app and document their reflections (using the learning management system) in written, audio and visual forms throughout their WIL experience; however, few did this effectively. The first version of the app was designed for mobile phones while most students continued to use a laptop to record their reflections and work on their assessments - they felt swapping to a phone was not easy. Many did not have an alternate device and the app could not be loaded onto their laptop. This finding aligns with our data (PAR cycle 1) and other research: students still using laptops for learning are less likely to employ smartphones (McGraw-Hill Education, 2017). Other students felt that using a phone to record or document their reflections in their WIL placement was not appropriate in the workplace context. In addition, the use of the app was optional, and not mandatory to completing assessments in the unit.

The uptake of the iReflect app by subject convenors was equally problematic, because of limited familiarity with the technology, and the time required to engage students, given the need to prompt and guide students in the use of the app. Convenors were likewise in need of this support. Individual students and teachers judged that the technology had great potential but had difficulty in adopting it in real time. Despite the fact that both convenors and students were collaborating with the app developer on refining the app, and students came in to speak with peers, this did not appear to increase student interest or use of the app. The outcome was that the app was not used effectively by the pilot cohort of students for the purpose for which it was designed.

The provision of a mobile app to support student reflection for learning is an example of personalised learning and given that this learning has been identified as a "difficult challenge" it should not be surprising that there were challenges in its adoption and use. The mindful integration of such technology has been identified as a "wicked challenge" for the Australian higher education context, with the caveat that it be "balanced with self-reflection" (Adams Becker, Cummins, Davis & Yuhnke, 2016, p. 4).

TABLE 4: User stories for a WIL reflection for learning app.

Uses of the software	Who is the user?	What will they use it for?	Why will they use it?	How will use be confirmed?
Recording reflections	Reflective practitioners (students and staff)	To record initial reflections, additions to and comments on a reflection, and cross-references between reflections. To record reflections in media that suit the practitioner and their circumstances - text, audio, photographs, video, (digital or digitised) drawings.	To document their reflections richly, in a way that the reflective practitioner experiences as 'natural' to the task at hand.	Rich 'documentation' of reflections is retrievable, embodying the organisation used by the reflective practitioner (e.g. updates and cross-references).
Reminders to reflect	Reflective practitioners (students and staff)	To create cues that prompt reflective practitioners to reflect and record their reflections - the cues are from students to themselves, and/or from teachers to students. Calendar reminders can be used; possibly geofence reminders (e.g. when leave a work experience site).	So that students don't forget to reflect, and to record their reflections; especially to help them meet course requirements.	Use of the app produces reminders to reflect only as per the user and teacher specified rules.
Organising information using self-determined categories	Reflective practitioners (students and staff)	To tag reflective practice items with tags created on the fly, and/or selected from predefined lists.	So they can find information easily.	Tags are used to retrieve all information associated with a tag, or set of tags, and *only* information that has these tags.
Choosing who has access to which reflections (i.e. particular texts, audio, photographs, etc.)	Reflective practitioners (students and staff)	To control who sees the reflections recorded in the app (e.g. using tags).	For privacy, for sharing, for marketing themselves to employers, etc. Add time limits around access.	People in groups / categories that reflective practitioners select can see the material made available to them, and no other material.
Asking questions, answering questions, and giving feedback	Reflective practitioners (students and staff)	To ask questions about reflection and/or about use of the app. To answer questions. For teachers to offer feedback and guidance. Questions will be routed to build a community of practice, e.g. by being routed to fellow reflective practitioners, before being escalated to teachers or to software support staff.	So app users can get help when needed. So academics and software developers address reasonable volume of thoughtful questions.	Questions are received and replied to. Feedback is provided. Reflective practitioners are able to help each other.

Uses of the software	Who is the user?	What will they use it for?	Why will they use it?	How will use be confirmed?
Making and restoring backups to protect against loss of data whilst protecting privacy	Reflective practitioners (students and staff)	To backup reflections to local and/or cloud storage, with options for automatic backup, and capacity to back up some material to the cloud, whilst backing up private data locally. To restore data from backups. Optionally to create calendar entries to remind themselves to back up.	So people don't lose data. So that people can protect data that they don't want centrally stored (e.g. for legal or personal reasons) from both technology failure and from hacking of cloud services.	Successful storage and restoration.
Reflection and App use help	Reflective practitioners (students and staff)	To get help with questions about how to reflect and how to use the app, e.g. - What is reflection? - How to start a reflection - What can you include? - How to post a reflection - Also include FAQs [E.g. (i) A translucent layer, with help re on screen items, displayed on first use, then when requested. (ii) Help available via on icon on the home page.]	Learn more about reflection and how to use the app.	Help is offered and accessed easily about both reflection and use of the app.
Upload to Learning Management System (LMS)	Reflective practitioners (students and staff)	To select and then upload material to the LMS, with material organised on the LMS to the reflective practitioner's requirements.	To share reflections with fellow practitioners and teachers, in ways aligned with class instructions.	Material is placed on the LMS, organised as per students' requirements.
Packaging, then publishing and archiving.	Reflective practitioners (students and staff)	To select material (e.g. with tags, with search terms, date ranges and/or manually), package it up (e.g. with a contents page, retaining cross-references), to support meta-reflection, to publish material in an eportfolio, and to archive it for future use (e.g. in personal cloud storage).	To help with reflections on general patterns in one's experience, to publish material as part of self-marketing, and to archive material for future use.	Material selected is presented, published and archived as per the selection criteria, retaining any internal organisation (e.g. contents lists, cross-references) created by the practitioner.

Lessons learned - the technological dimension

The research findings indicate that mobile-based technology cannot simply be offered to students as a tool to support learning through reflection. A subject convenor should have the technological knowledge, skills and capacity to guide students in using an app, and understand how to uptake the technology, but also engage with students as a part of the entire reflective process. Effective use of any pedagogical and technological tool needs to be scaffolded (Coulson & Harvey, 2013) through the course of the subject, and especially during the WIL experience.

Lessons learned - the institutional dimension

While there was initial support from the institution to trial the app (e.g. small grant funding), this did not extend to ongoing support for the integration of the app into the university's Learning Management System. There were also challenges in achieving synergetic outcomes between the institution and the organisation developing the app. In addition, staff attrition across the institution meant a loss of institutional knowledge (related to this project) at key milestones and therefore delayed progress. Staff attrition is difficult to control and account for but adapting a distributed leadership approach meant that while the project was delayed, it was able to continue as other CoP members assumed and shared the associated work and leadership.

SUMMARY AND CONCLUSIONS

As WIL becomes increasingly embedded within university degree programs its complexity is revealed. It can involve multiple participants with varying roles, distinct individual and experiential activity contexts, and diverse sites and locations. One constant in all of this is the recognition that reflection is pivotal to learning (Dewey, 1938; Rogers, 2001; Sykes & Dean, 2013), although approaches to, and the subsequent effects of this, can and do vary (Fook et al., 2006). In response to this complexity and to address recent calls for more online and mobile approaches to reflection for learning in WIL (Harvey et al., 2017; Trede, et al., 2016), the iReflect project was conceived.

The exploration of three ecological dimensions (institutional, pedagogical, and technological) led to the discovery of a series of opportunities, constraints, requirements, and catalysts. For example, there was clear demand and potential for the adoption of mobile technology that supports reflection for learning. Central to our ability to translate this into practical use was the documentation of user stories. A series of technological solutions (e.g. Pocket Studio, Pebble Pad and Mobile Learning) were explored, while user stories formed an evaluation benchmark when looking at packaged software, and as a design resource when collaborating with app developers.

These efforts brought some key difficulties into focus. Institutional tensions, including impediments to decision-making of which software should be adopted and where, and a lack of funding during this process as a result, played a prominent role. Given the rate of change in the design and use of technology platforms and applications, and the value of future thinking, the current reluctance of students to embrace mobile devices as a platform for reflection was particularly interesting. The central question this raises is: what is the right kind of mobility to support reflective practice?

For WIL users, at this point in time, tablets were a marginal presence, and laptops were easier than phones, so the mobile apps we experimented with made a much smaller contribution to supporting reflective practice than anticipated. However, the technological supports for reflective practice are continuing to evolve, and two predicted trends will change users' experience. Firstly, there is increasing

support for movement between devices - using the same application with each, when and where relevant to the user. Mobile phones, for example, are well suited to casual recording of short notes, but not long form writing, particularly when reviewing what one has previously written makes an important contribution to deepening one's thinking. It is suspected that seamless movement between phone and laptop would have enhanced project participants' capacity to reflect on, and particularly in the midst of, their WIL experiences. Secondly, the prediction is that with further developments in ease of use, and notably improvements in voice recognition (i.e. increased familiarity and accuracy with voice as the input medium), smaller devices will be more attractive to a larger portion of reflective practitioners in WIL. Ongoing creative experimentation with mobile learning in WIL can enable testing of such practices.

The key contribution of this research is the user stories - nine stories providing clear guidance on what WIL practitioners, in this study - students and teachers, require in their mobile technology to support reflection for learning. Colleagues are invited to take these user stories and use them as a reference point when they are evaluating the evolving technology offered, and to leverage them - adapting and adding to them - as opportunities to experiment with and develop new technologies for reflection for learning.

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