SELF-ORGANISING M-LEARNING COMMUNITIES: A CASE-STUDY
Glenda Nalder; Elizabeth Kendall; Victoria Menzies, Griffith University, Australia

ABSTRACT
This case study applies a ‘living systems’ theoretical model for m-learning community formation (Nalder & Dallas 2006) to an early intervention learner driver education program. The program, for 16 year olds, targets hazard perception ability, attitude, and behaviour as key contributing factors in crashes. The paper focuses on a key phase in the program (in-the-field learning episodes and self-reported driving behaviour) for which tools were designed utilising available context aware and location related applications for mobile devices. Choices are rationalised in terms of applicability to education for meta-cognitive development, capacity for user self-management, and adaptability. These criteria were essential as subsequent research phases involve measuring and reporting on medium and long-term impact (up until age 25). The implications of two emerging trends are considered: firstly, the proliferation of Application Programming Interfaces (APIs) for diverse devices that are designed to grow internet-supported m-commerce, and secondly, the broader uptake of new on-line genres that has created more accessible spaces for social interaction. The paper concludes that these trends are more effectively considered by education designers from the perspective of how they are or may be co-opted and creatively adapted by the user.

Author Keywords
sustainable m-learning communities, living systems, self-organisation, context-aware, location-based software, m-learning tools

INTRODUCTION
Purpose:
The purpose of this paper is to present the results of a study that sought to test the viability and transferability of a systems theoretical model for the formation of self-organising m-learning communities (Figure 1, below). The model, which was devised for use in institutional contexts with www-based learning management systems (LMS), was premised on two notions. The first was ‘swarming’ - a metaphor for mobile-phone-user social behaviour borrowed from the biological sciences. The second was the interoperability and adaptability for learning purposes of Application Programming Interfaces (APIs) already in use for other services (such as ‘pushing’ information about restaurants to users based on their proximity to a particular geographical location, or matchmaking based on a personal preference profile).

The following sections provide, in order, (i) the study background which explains the context for the study and the influence of context on outcomes; (ii) the overarching research methodology – a fusion of Multiple Perspective Analysis Convergence (MPA-C) (Ecker & Baker, 1984), Participatory Design (PD), and Philosophic Inquiry (PI); (iii) the results, in terms of technologies, applications, pedagogical strategies and learning tools; (iv) the discussion of the results, relative to the key concepts – self-organisation, sustainability and transferability; and (v) conclusions – summary of achievements and contribution to new knowledge.

Background to the case-study
The context for the study is a community-based early-intervention Young Learner Driver Education Program (YLDEP) for 16 year olds. This was not the context for which the self-organising m-learning community model (Figure 1 below) was devised. This model was devised for adult learners seeking undergraduate or postgraduate qualifications through an Open University Network. However an opportunity arose to test the model on a not-for-profit Community-based Education (CBE) program, resulting in a significantly different, but productively challenging context for the proposed pilot study.
Three key features that distinguish CBE from Community Education (CE) and Institutionally-based Education (IBE) had an influence on the study outcomes. These were (1) that CBE is primarily “a form of social action within a community framework that extends beyond schools as institutions”; (2) that CBE is considered empowering, in that it “allows community members to become self-oriented participants in the creation of the learning environment”; and (3) that the form of CBE is likely to be “more dynamic” (than either CE or IBE) (Corson, 1998:238).

The advantages of these three features for this pilot study are (1) that many of the barriers to experimentation leading to educational innovation are institutional, and while educational institutions seek to empower learners, it is often difficult to achieve learner empowerment because of systemic and regulatory constraints; (2) that self-orientation in participation (a characteristic of CBE) is highly compatible with self-organisation – an aim of the model; (3) that the dynamic form attributed to CBE was characteristic of the YLDE program, which operated via feedback loops between community resident experts, the participants, and the researchers, (as the University is located within, and considered part of, the community). This meant that the program was not a ‘closed’ system. The program’s flexibility and openness to adaptation are characteristics of ‘living systems’ that are essential to its sustainability. Along with transferability, sustainability is an important goal for the YLDE program.

Thus the intentions for the YLDE program were clearly sympathetic to the model that the study sought to test. So the CBE context can be seen to advantage and simplify the study by eliminating some of the more difficult challenges to the model that would certainly have arisen in an IBE context. Further, the CBE context directed the study toward the examination of user-side, rather than provider, or server-side applications. And, while this may be perceived to be a limiting factor in terms of IBE interests, it is possible that this direction may be a consideration when Open Learning Institutions seriously embrace m-learning. Therefore a key task for the study for the IBE context was to consider the viability of assessment that is based on learner participation and learner-data-based evidence, in conjunction with other strategies that cater for learner-centredness and mobility.

The formation of self-organising learning communities is an important phase in the YLDEP, following the initial 10-module workshop program delivered to 16 year olds in community and school settings. The community workshops cater for young people who do not attend school. Workshops are also held for parents, carers or mentors who will be supervising the driving practicum. The m-learning community formation begins after the workshop program when parents, carers or mentors drive learners on local roads as their complete the post-course learning assessment task, which tests their readiness to apply for a learner driver permit to begin their practicum. New regulations apply to practicum that require learner drivers to log 100 hours of supervised driving pre- and post-license. Thus a tool for logging (or blogging) self-reported data would be advantageous. As well, the necessity to maintain open communication channels on completion of the face-to-face workshops is crucial to the proposed longitudinal study that will evaluate the YLDEP’s long-term impact by monitoring the driving behaviour and records of participants until they are 25 years of age.

METHODS
Methodological Framework
The case-study – a pilot trial of tools and a model for self-organising m-learning community formation - is part of the formative evaluation phase of the YLDEP, and sits within a larger research program that culminates in a longitudinal study. Ecker & Baker’s (1984) Multiple Perception Analysis Convergence (MPA-C) model was selected for the formative evaluation phase for two reasons: firstly it supports the
collection and analysis of data derived from qualitative and quantitative evaluations of education programs, and secondly, because it attends not only to the educational, but also the social, and psychological dimensions of a learning situation. This aspect is important given the focus of the YLDEP on behavioural change. As well, the MPA-C model is responsive to changing educational contexts. Thus it is, arguably, suited to the dynamic and multi-layered YLDEP, which is the context for this study.

YLDEP is taught by a team of professionals from several disciplines in diverse contexts e.g., students in schools who are about to become learner drivers, as well as learner-drivers and parents and/or carers of learner-drivers in community contexts. The MPA-C model is suited to this context because it teams outside evaluation specialists with stakeholders in the development and delivery of a program to record the perceptions of all participants in a non-hierarchical format, for subsequent subjection to a cross-disciplinary analysis. Inter-subjective verification of perceptions is then achieved through independent reviews of audio and video recordings, interviews, observations, and questionnaires. Converging and diverging perceptions are then submitted to program members or participants for their responses, and the final multiple perception analysis (MPA) is submitted to an additional outside review panel of ‘critical friends’. Responses to open-ended questions were analysed using Leximancer™ software to quantify data generated via qualitative methods. Leximancer™ is a qualitative research tool that uses semantic mapping to develop concept maps from natural language. The concepts identified through this analytical software are graphically presented to indicate the relative importance of, and interrelations between, concepts. Subsequent breakdown of data in terms of discriminating, stable and multivariate indices provides a means to identify skill and knowledge base development; and to distinguish variances between contexts.

Embedded within the overarching MPA-C model are Community of (Philosophic) Inquiry (PD-CPI) methods (Nalder, 2004), explained in detail below. The PD-CPI method supports the simultaneous development of an education program while enhancing the learning outcomes. It does this by engaging participants in ‘authentic’ learning experiences that involve them in the generation of content and resources pertaining to local contexts that illustrate their understanding of concepts.

**Participatory Design**

End-users (adolescent learners) have been involved in the YLDEP design from the outset, via a Participatory Design (PD) process. For example, participants were involved as actors in the production of interactive learning resources for the LDEP with professional and young student film-makers and animators from the University’s Film School. User-feedback elicited through an inquiry process (explained below) has been incorporated into each phase of the program.

PD was pioneered in Scandinavia in the 1960s by computer systems engineers, who used a ‘collective resources’ approach to systems development that involved end-users and unions in the design process, recognising “the importance of perspectives, interests, conflict and participation among multiple expertise standpoints in the design process” (Levinger, 1998). More recently, PD has adopted ethnographically informed strategies, including ‘cultural probes’ to engage user groups through the introduction of ‘artifacts’ that encourage interaction so that multiple perspectives can be considered and conflicting views expressed in non-threatening contexts. This strategy was used in post-course evaluations to generate rich data for subsequent analysis. Although PD is an important break-through in terms of recognising user perspectives, recent education research has shown that programs that involve participants in ‘authentic’ experiences (rather than in simulations or games) lead to deeper learning. Therefore the post-workshop activities around which the m-learning community is formed are undertaken ‘in the field’, and constitute the application of classroom-based learning experiences in ‘real life’ contexts.

**Community of Inquiry Process**

A Community of Inquiry (CI) approach was adopted from the outset that engages research and development groups and program participants in interactions that differ from the standard model used to address research questions or problems. The CI approach addresses three elements: domain, community, and practice (Wenger, 2001). Integral to our adaptation of this approach is the process of Philosophic Inquiry (PI) whereby the question itself is the discovery of the subject. This process involves the community of learners in the analysis of concepts through externalised group thinking. Interdependent thinking is then internalised into individual thinking. The participants discover and/or unpack the question for themselves, leading to a more focused and reliable outcome. (PI is an approach
to learning based on the work of Lipman in the 1970s to develop higher order thinking skills and deep cooperative learning). This process also underpins the approach to the activities that engage YLDEP m-learning community members in on-going self-reflection and self-reporting.

Selection and role of case-study participants
The YLDEP engaged adolescent participants in a 10 module 2-day workshop program, and parent-carer-mentors in a separate 3-hour workshop, both delivered in dual contexts: school and community. The 10 participants in the m-learning community case-study are graduates of the first community-based workshops undertaken in the program’s ‘home’ community, who volunteered to participate in the long-term research program. They are in the second phase of the program, which engages learners and driving mentors in the ‘in-the-field’ application of the knowledge they gained through the face-to-face workshops. In this phase, learners are driven by their mentors on a local area route mapped by resident professionals from the fields of policing and ambulance services. The route is devised to maximize their encounter with known road ‘black spots’ (sites of frequent serious road accidents). Tools are provided to enable the learner drivers to record their responses using mobile devices for subsequent upload to their blogs, where feedback is provided on their readiness to proceed to the next phase (supervised driving practicum).

RESULTS
The results of the m-learning community formation case-study are reported below. Aspects covered are, pedagogical strategies, m-learning tools, technologies, and applications; social networking tools and spaces.

M-Pedagogy
During the past five years education researchers interested in exploring how the use of mobile devices by learners can be accommodated have emphasized the necessity for pedagogy to co-evolve. Syvanen & Nokelianen (2004:191) undertook an extensive review of mobile learning materials and environments using an on-line tool to develop their Components of Mobile Learning (CML) model, which listed the following 10 criteria for pedagogical usability: learner control, learner activity, cooperative learning, goal orientation, applicability, effectiveness, motivation, valuation of previous knowledge, flexibility, feedback. While these criteria could equally apply to learning in static contexts, they do provide a useful checklist for consideration in terms of how these criteria might become essential attributes of the conditions required for m-learning community self-organisation. To achieve this, consideration was given to how the cultural and social as well as the technological specificities of the mobile mode of communication could be co-opted for the development of tools for self-managed learning in the post-workshop (in-the-field) pre-practicum phase. These are detailed below.

M-learning tools
The first consideration in the development of the m-learning tools was that they should be purpose- and usability-driven. Purposes were to:

(1) collect evidence-based data about impact of phase one of the YLDEP on participant cognition, attitude and behaviour on the basis of the practical application of learning "in the field" in a manner that is likely to engage participants and sustain participation;
(2) build in assessment instruments (e.g., the digital field journal) that will position the YLDEP within the category of "structured community-based courses" for accreditation toward a senior school certificate; and
(3) provide a 'proof of concept' for the next phase (supervised practicum log).

In keeping with the PD process through which the program had evolved, user groups participated in the design of the tool – a digital field journal for recording evidence that graphically demonstrated their ability to meet the road-readiness criteria for obtaining their learner-driver permits and beginning their supervised practicum. Learning undertaken in workshops was applied to a local area map with a pre-determined route comprising a variety of road types and terrains (e.g., urban and rural conditions, speed limitations and surface types and hazards including rail and school crossings) to be driven along by the parent-carer-mentor with the learner as passenger. Freely available device and context aware resources to support this task were identified, and are outlined below.
Freeware m-learning resource options:

1. Google Maps
Google Maps, a recently available mapping service, provides access to maps with landmarks and satellite imagery as well as generating driving directions. Users are able to create their own maps (mymap) to which they can add their own landmarks or points of interest. Text descriptions and photos can be added (with a little HTML knowledge). Once a map is saved it is assigned a unique URL. This service could be used in two ways on mobile phones.

- Maps for mobile, a downloadable application, functions on most Java-enabled (J2ME) mobile phones, Palm devices with Palm OS 5 and above, all colour BlackBerry devices, and Windows Mobile devices with Windows Mobile 2003, 5.0 and above. (http://www.google.com.au/support/mobile/bin/answer.py?answer=40662)
- Mobile Web, accessible by any Internet enabled phone enables users to visit mobile.google.com/local on their mobile browser. Once there, they could search for landmarks, view maps, and find driving directions. (http://www.google.com.au/support/mobile/bin/answer.py?answer=40662)

GPS technology Google Maps for Helio subscribers and for Windows Mobile devices (regardless of provider) were enabled with GPS. However when accessed by other devices Google Maps did not use any GPS technology, even if those phones had a built-in GPS location device. (http://www.google.com.au/support/mobile/bin/answer.py?answer=39894&ctx=sibling)

Google Maps is a free service, but use involving telcos meant that rates applied. However, this could be overcome if users accessed google maps from a web browser on a standard computer, via http://maps.google.com.au/

2. Whereis
Whereis, an Australian mapping service that sources digital maps from UBD (the largest publisher of mapping products) could be accessed in two ways: through either a web browser, mobile phone or GPS navigation system.

- Whereis® Navigator - an application that operates on compatible mobile phones and personal digital assistants, provides access to Whereis Map Data and points of interest. Specifications include Software CD, unique license key, GPRS or CDMA 1X/eVDO data connection; Bluetooth or Serial GPS Receiver (NMEA compatible should work correctly however Sensis only supports approved GPS Receivers.); 3MB memory free. Models supported include Nokia 6600; Nokia 7610; Siemens SX; iMate PocketPC; iMate Smartphone2; XDA I & II; HP iPaq 4150 & 2210 (in combination with wireless data connection); iMate JAM; iMate Smartphone, SP3 & SP3i; iMate PDA2K; HP iPaq 6315 series; Panasonic x700, and Telstra – GPS enabled devices.

- Whereis Mobile allows users with any internet enabled phone to visit http://mobile.whereis.com for access. Once there users could get directions, look at maps with points of interest and locate a range of nearby services. Telstra customers were able to invite their friends who are also on the Telstra network to join Whereis® Everyone, enabling users to find the approximate location of their friends at any time. Although Whereis Mobile works on any Internet enabled phone, data service rates apply from telcos: http://www.whereis.com/whereis/personalMaps/whereisMobile.do.

Whereis API, a commercial API, provides the means to publish maps, directions and embed location-based services into business application and websites. As the name suggest, this is generally a commercial service but The Whereis Workshop API is available to individuals seeking to The basic features of this service are the ability to generate maps centered on specific street addresses with embedded icons representing businesses or other points of interest and specific route maps and turn-by-turn instructions between one street address and another: http://www.whereis.com/whereis/businessSolutions/navigationApi.do

Telstra and Whereis Telstra offer Whereis as a service on their next G network, with options for a pay-per-use cost of approximately AUD 1.25 to view a map, or a data package (ie 10mb download for AUD16/month).
Figure 2. Digital field journal: interactive road map with participant-inserted road hazard identifier, tagged with risk assessment entry.

Figure 2 (above) illustrates the use of an interactive mapping system for the field journal process. The interactive local area map with the prescribed driving route was made available to participants in various formats using the map generation and mash-up facilities accessed by the program developers (on the basis that the CBE program was a not-for-profit community service.) Participants were required to complete a field journal in order to demonstrate their readiness for obtaining a learner driver permit and undertaking the pre-license supervised practicum. The field journal tasks were:

(a) locate a hazard that required driver decisions
(b) record the road rule(s) to be followed
(c) state the appropriate driver attitude or modification to driver attitude
(d) state the appropriate driving behaviour and/or modifications to driving behaviour required in response to the hazard
(e) identify the potential consequences of not modifying driving behaviour and
(f) record incidents of inappropriate (risk-taking) driving behaviour they observed during the journey (whether by their driving mentor, or other road users).

Their location on the readiness matrix scale was subsequently assessed, and feedback provided, on the basis of their recognition of applicable road rules, hazard recognition, and appropriate risk avoidance behaviours on the pre-determined route map hazard checklist prepared by the program development and teaching team (expert professionals in the fields of policing and ambulance services).

Participants were also provided with hard copy print-outs of the area map and field journal entry sheets, and were asked to photograph the “black spot” locations using mobile phone or digital cameras. This strategy aimed to provide options for participants to use tools of preference to record their field observations.
Learner-managed Social Networking tools/spaces

A characteristic of CBE is its reliance on freely provided support from within the community or sponsors. Transfer of the YLDEP to different community contexts will result in variable conditions. Therefore technology is more usefully understood as 'idea' rather than as 'object' or 'thing'. This suggests that usability criteria that is applied in IBE contexts, such as that derived by Syvanen and Nokelainen (2004:191) (accessibility; ‘learnability; memorability; user control; help; graphical layout; reliability; consistency; efficiency; memory load; errors) are best considered by the user rather than the provider on the user’s behalf. Thus in a self-organising CBE situation, decisions about how data could be protected and maintained for the life of the research program are important. It is anticipated that participants would upload their field journals to a YLDEP website hosting blogging facilities, including the field journal structure and feedback report for program participants. A code of conduct and access privileges would need to apply. The community-based teaching team would assess the submissions and provide feedback and rate the response on a "driver readiness" scale.

The following overview of social networking tools and spaces is undertaken from the perspective of youth participation in Internet culture. While adolescents are accustomed to using or accessing sites created using a wide variety of freely available tools and spaces such as Wikis, Blogs, Internet Forums, MySpace, or photo and video sharing sites, CBE program convenors may be less likely to be familiar with these. A review of social networking tools and spaces was therefore conducted as background research to the study. Results were as follows:

Wikis
A Wiki is a website that is able to be collaboratively edited by its users, who are also able to alter each other’s texts. Wikis can also include features such as calendaring, discussions, to-do lists, file uploads including images for image galleries. There are many publicly available "wiki farms" that enable anyone to create their own wiki, and, depending on the service, the wiki can be open to public access or be password-protected for privacy. A disadvantage of free wiki farms is that they generally contain advertising on every page. However it is possible to build a wiki using open-source software and host it privately.

Blogs
A blog or web log is an online diary of sorts. It is essentially a website that allows users to add text entries and others to leave comments. Some blogs allow upload of images. Popular free blogging tools include blogger and wordpress. Blogger is a free web-based tool for instant web publication. Blogger Mobile allows users to update blogs via MMS or email. This is not supported in Australia yet but indications are that it will be soon.

Internet Forums
An Internet forum is an online discussion group also referred to as web forums, message boards, discussion boards, (electronic) discussion groups, newsgroups, discussion forums and bulletin boards. A sense of virtual community often develops around forums that have regular users. Technology, computer games and/or video games, fashion, religion, and politics are popular forum themes. ([http://en.wikipedia.org/wiki/Internet_forum](http://en.wikipedia.org/wiki/Internet_forum))
Forums are generally simple to use and are often part of social networking websites. MySpace has forums that are among the most popular on the web. ([http://rankings.big-boards.com/?sort=alexa](http://rankings.big-boards.com/?sort=alexa))

MySpace
MySpace is a popular social networking website offering an interactive, user-submitted network of friends, personal profiles, blogs, groups, photos, music and videos. ([http://en.wikipedia.org/wiki/Myspace](http://en.wikipedia.org/wiki/Myspace)). MySpace users can have a personal profile, upload images, video and audio files, keep a blog and participate in forums all from the one website. MySpace is currently the world's fifth most popular English-language website and the fifth most popular website in any language (Alexa Internet's Alexa.com's website rankings system and top 500 global websites. 2007) The local (Australian) MySpace was launched in August 2006.
Myspace mobile users can access MySpace content via mobile phone, edit their profiles as well as communicate with, and view the profiles of, other members. This is only available through certain telcos.
and not yet in Australia. Although Australian users could use any browser capable phones to access the Myspace website, MySpace mobile is not yet available in Australia.

Photo & Video sharing websites (eg Flickr Youtube)

*Photo and video sharing* is the publishing or transfer of a user’s digital photos or video online, thus enabling the user to share them with others (whether publicly or privately). This functionality is provided through both websites and applications that facilitate the upload and display of images and video. Most photo and video sharing sites provide multiple views (such as thumbnails, and slideshows), the ability to classify photos into albums as well as add annotations (such as captions or ‘tags’) and comments. (http://en.wikipedia.org/wiki/Photo_sharing)

*Mobile Photo Sharing* There are mobile applications available that enable the automatic transfer of photos taken with a mobile phone, to photo sharing sites, either directly or via MMS.

*Youtube* is an online video streaming service that allows the viewing and sharing of videos that have been uploaded by its members. Membership is free (http://www.google.com/support/youtube/bin/answer.py?answer=55749&topic=10509)

*Flickr* is a photo sharing website and web services suite, and an online community platform, which is generally considered an early example of a Web 2.0 application. In addition to being a popular website for users to share personal photographs, the service is widely used by bloggers as a photo repository. (http://en.wikipedia.org/wiki/Flickr)

**Flickr Mobile:** Flickr is the name of an online application to which any mobile browser provides access. Through the mobile browser, Flickr enables the management and sharing of digital photos or any image saved in the JPEG format. (http://help.yahoo.com/l/us/yahoo/mobile/flickr/flickr-01.html) Users can upload images directly from phones by application or email or via their mobile browser to m.flickr.com

From the above review, the scope for community-building, self-organisation and knowledge sharing through social networking is arguably broad and varied, and increasingly open to mobile access. However mobile phone access to freeware and free spaces is often made prohibitive by telecom pricing structures. At the same time, the dynamic and evolutionary form of virtual social networks is based on the capacity of these systems to be open and adaptable to changing circumstances.

**DISCUSSION**

A primary consideration in the design of tools and procedures for self-organising m-learning community formation is that these should be interactive, interoperable and dynamic, but more importantly, they should engage young learners in a way that encourages and supports meta cognitive development and attitudinal and behavioural change. The formative evaluation process that fed into the program design was a significant element of effective education design that is well documented in educational fields, but is a notable oversight identified in the literature on learner-driver education program outcomes (Lonero & Clinton, 2006). Participatory Design (PD) strategies used to introduce this phase to the YLDEP design – pre and post-course - generated data, the analysis of which enabled the identification of early indicators of positive behavioural change attributable to unique distinguishing features of this Community Based Education program: the active involvement of learners in the creation of learning objects (films and animations), and opportunities for participants to engage in authentic in-the-field learning experiences where they apply concepts learned in creative and active ways. Although PD is rarely considered in educational design in IBE contexts, adopting self-organisation as a principle may be the first step in empowering learners through a user-centred evolutionary approach to educational design.

Engaging participants in the capture of criterion referenced learning evidence using mobile methods and social networking tools resulted in not only richer feedback data from outdoor contexts than that able to be gathered by a researcher-observer (Isomursu, Kuutti & Vianamo, 2004), but in deeper learning through critical inquiry and reflection.

**CONCLUSION**

In the Living Systems or ecological theoretical framework applied in this case-study, ‘technology’ was not treated in fixed and abstract terms, as a tool or thing to be ‘embedded’ in the human life-world, but rather, as set of ideas circulating via feedback loops. The behavior and emergent properties of social systems supporting the familiar patterns of interaction and collective organization that characterize the voluntary and community sectors can be understood through complexity theory. In this theoretical model, social organization is characterized as a complex, multiply-interconnected network whose components are constantly changing, being transformed and replaced by other components. (Nalder, 2002). In an environment dominated by the forces of technological and structural change, organisms that survive are
those capable of co-evolution. Thus education systems must not only adapt to the new conditions wrought by wireless and mobile technologies, and their application to production, dissemination and consumption, but also co-evolve.

REFERENCES


