

Preface

Using technology in teaching and learning is mostly an exercise in appropriation. Most of the technology tools we use in the classroom are consumer devices, not pedagogical devices. We might, for example, use a digital tool for a learning activity, but the way that it is used is open to interpretation both by the teacher and the student. The same device may be used for many other purposes during the day, some educational, some not. Indeed a learner may be constantly task switching between multiple activities, moving in and out of learning and virtual social contexts (Rosen, 2010.) Increasingly, activities become harder to classify as learning, as opportunities for learning become more informal and opportunistic. Online resources and portable digital devices give us access to information anywhere, any time. This gives us increasing control over where and when we choose to learn, and how we choose to separate or integrate learning and other activities. Thus there is a blurring of boundaries between what is learning and what is something else, and what the roles of digital tools might be in this blending of learning and increasingly mobile lives.

This is not to say that there are no technology tools that have a specific educational intent. Areas where we see them being targeted at learning tend to be in the interface between hardware and software, for example Makey Makey (Beginner's Mind Collective & Shaw, 2012), Arduino (Banzi, 2011) and Lego Mindstorms (Ferrari & Ferrari, 2002.) Such tools provide opportunities for social constructivism and constructionist learning (Papert & Harel, 1991). Indeed this is a well-established theme in educational ICT that includes past initiatives such as the BBC Micro (Fitzpatrick, 2011) and the Logo Turtle (Solomon, 1978). These types of activities exemplify the blend between the use of technology and the social, collaborative learning styles of the contemporary classroom.

The plethora of devices and learning modalities that are now available to us tend to blur the boundaries between different types of technology enhanced learning. This has long been the case for mobile and blended learning, where the use of mobile devices has frequently been integrated into blended learning scenarios. This overlap becomes even more common now that the definition of what is, or is not, a mobile device has more to do with how a particular tool is used than its form factor. We can see this in the study of affordances, where the definition of mobile learning is focused more on types of learning activity than it is on which device the learner might have. Nevertheless, there are some distinctive characteristics of both mobile and blended learning that make it possible to differentiate most research as being primarily in one camp or the other.

Regardless of how we classify these investigations, the overarching question that we address in this volume is what types of mobile and blended learning innovations might lead to improved learning outcomes? The *International Journal of Mobile and Blended Learning* has been published since 2009, exploring these themes from a multitude of perspectives, so what new frontiers remain to be addressed

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in this field of research? In the following sections, we explore the key characteristics of both blended and mobile learning. Through these analyses, it is clear that both types of learning encompass complex interactions between technologies, pedagogies, contexts and individuals that provide an almost limitless set of opportunities for innovative work that explores new ways to teach and learn.

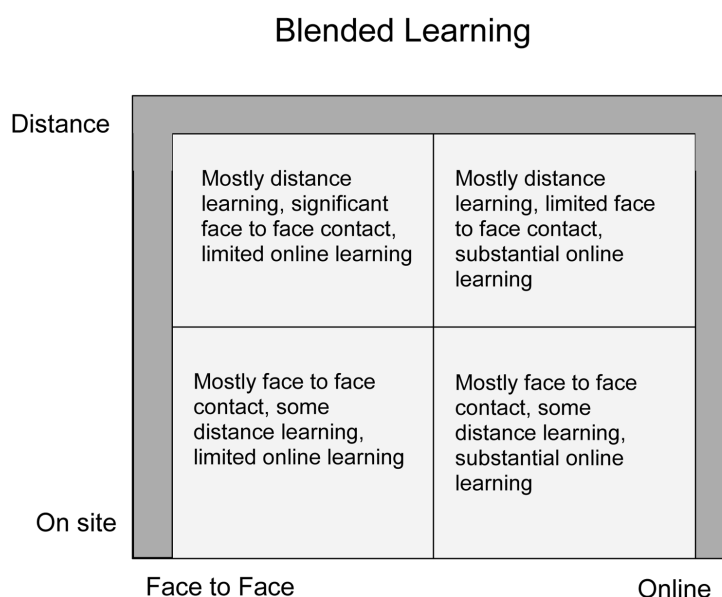
DEFINING BLENDED LEARNING

From simple beginnings at the BBC in 2000, when free online courses were supplemented with web based resources (Parsons, 2011), we now see multiple interpretations of what blended learning might mean. One view is that we can categorise blended learning practice into a range of specific types; the rotation model, a classroom centric approach where students move between online and face to face learning (this model includes the flipped classroom), the flex model, where some learning takes place onsite but is primarily delivered online, the a la carte model where online courses are mixed with other face to face courses, and the enriched virtual model where the online learning complements onsite learning (Clayton Christensen Institute, 2015). Such distinctions are somewhat arbitrary but may help in planning the mechanics of blended learning delivery. In essence, behind these models, there is a long continuum from blended learning that is predominantly face to face with some online support, through to learning that is predominantly online with some face to face support. It has been suggested that blended learning is where 30%-70% of the instruction is delivered online but, like the various models, this guideline should not be considered as any kind of rule (Blended Learning Toolkit, n.d.) As Garrison & Vaughan (2008) point out, the balance between face to face and online learning should be a thoughtful fusion, not just an arbitrary division. In addition there is a distinction between learning that takes place online, regardless of location, and online learning that is intended to take place in a specific situation, such as within a formal on-site class. Thus within the scope of blended learning there are two relationships; one between online and face to face learning, and another between on-site and distance learning, which will both vary depending on the context. Figure 1 represents these relationships as a quadrant diagram. One important feature of the diagram is that it indicates (as dark grey areas) combinations of factors that are not blended learning, namely learning that is all online, learning that is all face to face, and learning that is all distance. However it is possible to blend learning to take place exclusively on site, provided that some online learning is involved. Whilst this diagram does not necessarily imply any value judgment, it would seem likely that a blended learning programme that is taking full advantage of the opportunities offered by online learning would fall into either of the two right hand quadrants.

DEFINING MOBILE LEARNING

In the early days of mobile learning, finding a definition for it was perhaps simpler than it is today, since the devices themselves (early mobile phones and personal digital assistants) were easily distinguished from less portable devices such as desktop computers and early generation, heavy laptops with limited connectivity options. Voice, text and data connectivity through cellular networks was often an advantage in the days when WiFi connections were few and far between (indeed it still is in many situations.) As devices and networks have converged and there is a blurring of boundaries between what is, or is not, a mobile device, what is clear is that mobile learning is defined more by its affordances than by a par-

Figure 1. Quadrant diagram of the dimensions of blended learning

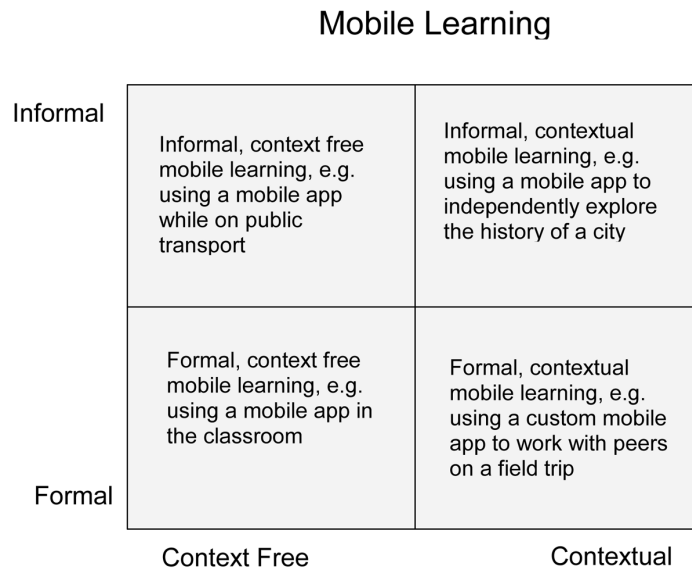


ticular piece of hardware or software. The most obvious affordance of mobility is the level of portability (Naismith et al., 2004.) Whether I can use a device in my hand that I carry my pocket and is immediately available, or whether I have to carry it in my bag or my backpack and start it up when required, really makes a difference to the simplistic concept of anytime anywhere learning. Nevertheless if we dig a little deeper, we can identify a range of other affordances of mobile learning, including gathering data (Orr, 2010), communicating (Liang et al., 2005), interacting with the interface (Lai et al., 2007), contextual, active learning (So, Kim & Looi, 2008) interacting with an outdoor environment (Tan & So, 2015) and interacting with other devices (Parsons, Thomas & Wishart, 2016). Thus even in a world of device convergence, mobile learning as an activity still has unique characteristics.

If there are two dimensions of relationships in blended learning, are there similar types of relationship in mobile learning that will also help us to understand this field of research? A review of the literature makes it clear that there are some core concepts that can be put into a similar quadrant view. Along one dimension is the difference between formal and informal learning, since one of the main benefits of learning on a mobile device is that it is personal, and its use is managed by the owner, not by a third party instructor (Clough, Jones, McAndrew & Scanlon, 2009). Nevertheless mobile devices can be, indeed are, used to great effect within formal learning environments. Another important concept that relates to mobile learning is that of context. It is worth noting that the annual conference of the International Association for Mobile Learning (IAMLearn) is called the World Conference on Mobile and Contextual Learning. Thus context is seen as being equally as important as mobility. This is because the mobility of a device enables it to be brought into many different learning contexts, where features such as location awareness, sensors and ubiquitous technologies can be leveraged to provide rich learning experiences. Figure 2 represents the relationships between formality and context in mobile learning as a quadrant diagram.

Unlike Figure 1, there are no areas of the quadrant that are ‘out of bounds’ for mobile learning. For example formal, context free learning with a mobile device is still mobile learning. Again, like Figure 1, this diagram does not necessarily imply any value judgment, but it would seem likely that a mobile

Figure 2. Quadrant diagram of the dimensions of mobile learning



learning activity that takes full advantage of mobile affordances (including communicating for collaboration) would fall into the lower right hand quadrant.

Although the quadrant relationships outlined here for blended and mobile learning have different concerns there is, in fact, some overlap between them. For example context is important in both cases. In blended learning, the key component of context is engagement within the classroom, whereas in mobile learning perhaps the most important concept of context is that which engages the learner outside the classroom. We might also perhaps recognise that distance learning can in some ways be aligned with informal learning. However there is an important difference here, in that blended learning programs often provide formal structures, content and processes for the distance component, whereas when we talk about informal learning with mobile devices there is no expectation that this learning is being driven by educators, but rather that it is being driven by the individual.

This book has been arranged into sections based on the primary concerns of the authors. The first section includes those chapters that address the topic of blended learning. This is followed by a section of chapters that focus primarily on mobile learning. The third section includes chapters that address both mobile and blended learning in an integrated manner. Finally, there is a section of review papers that reflect on previous research into mobile or blended learning.

BLENDED LEARNING CHAPTERS

The first chapter in the blended learning section is “Evaluating Learning Experience through Educational Social Network Support in Blended Learning” by Marva Mirabolghasemi and Noorminshah Lahad. This chapter explores Garrison and Vaughan’s (2008) Community of Inquiry (CoI) model in an environment where an educational social network (Edmodo) was used in conjunction with a course management system (i.e. a learning management system such as Moodle) and face to face teaching and

learning. The authors investigate the three components of Garrison, Anderson, and Archer's (2000) CoI model, namely teaching presence, cognitive presence and social presence in blended learning. While the results of the study confirm the importance of all three types of presence, they particularly emphasise the importance of social presence in the overall learning experience of students. This may be because participants who engage in blended learning courses see the value of opportunities for social interaction to support their learning.

This is followed by a chapter from Oman, "Blended Learning in Oman: Confronting the Challenges of Higher Education" by Virendra Gawande. This chapter explores the development of a Blended Learning Acceptance Model appropriate to the adoption of blended learning in Oman, based on an e-learning acceptance model. An important source for this chapter is Picciano (2009) because of the reference to cultural and individual differences of learners, faculty and course designers in the application of multiple blended approaches. Research questions posed for the study reported in the chapter looked at teaching styles and learning styles, and how these might impact on user acceptance and behavioural intention with regard to blended learning. The study was undertaken using a survey of 841 students and 30 teachers. There were 18 hypotheses examined using the data from these surveys. Although learning and teaching styles appeared to have limited effects on potential adoption, demographic factors were found to play a role. Interpreting the results from this study is not straightforward, but it represents an important part of the process of developing blended learning policies in a specific national and cultural context.

Continuing the theme of investigating blended learning innovations in specific national and cultural contexts, the third chapter in this section is "Is Flipped Classroom a Tendency or a Fad? The Point of View of Future Teachers in the Philippines" by Michel Plaisent, Filomena Dayagbil, Angeline Pogoy and Prosper Bernard. This chapter tackles the popular blended learning approach of the flipped classroom, and analyses its role in the Philippines. The authors cite Mazur (2013) in identifying the following four aspects of the flipped classroom approach; constructivist pedagogy, inquiry, student-centered learning and active learning. Whilst recognising the potential of the flipped classroom, the chapter also investigates the potential negative aspects including equity of access to digital tools and internet connections required for flipped classroom activities to be undertaken. The survey reported in the study investigated pre-service teachers' knowledge and attitudes towards various aspects of the flipped classroom. The survey questions were structured around the four pillars of FLIP; flexible environment, learning culture, intentional content and professional educator (Flipped Learning Network, 2014). The authors gathered 153 valid responses for analysis. Although the pre-service teachers demonstrated enthusiasm for the flipped classroom, they lacked knowledge of the approach, and the authors caution that other studies do not necessarily show benefits. There are further reservations about how such an approach would work within the Filipino context. Thus the chapter concludes that further investigation is required to ensure that any move towards the flipped classroom in the Philippines recognises both evidence from past practice and the specific national and cultural context.

The last chapter in the blended learning section of the book is "Learning about Blended Learning through Postgraduate Student Experiences in Australia and Singapore: An Exploratory Study in Guidance and Counselling" by Margaret Carter, Paul Pagliano, Cecily Knight and Donna Goldie. The study discussed in this chapter investigated seventy three postgraduate students' experiences with blended learning in guidance and counselling programs in one Australian university with an offshore branch campus in Singapore. In their exposition of blended learning, the authors reference both the CoI model and the seven principles of good practice in undergraduate education (Chickering & Gamson, 1987.) The study described in this chapter examines students' perceptions of their experiences with the blended

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guidance and counselling programs taught across international university campuses. There were two online surveys, followed by a focus group that further explored issues raised by the two surveys. The study aimed to find out about the experiences of students in their blended guidance and counselling programs and how these experiences might be improved. The research took over three years and involved 73 postgraduate students. Eight themes were reported within the data: blend as a multidimensional concept; communication and connectedness; arranged collegiality; digital literacy; information communication technologies; discipline knowledge; authentic support; and reflecting about action. The chapter concludes with a number of recommendations and actions that the study has revealed as important in improving the delivery of blended learning in this context.

MOBILE LEARNING CHAPTERS

The opening chapter in the mobile learning section is “Improving Teaching Practice in Early Childhood Supported by Mobile Technology” by Kathryn MacCallum and Heather Bell. This chapter discusses an ethnographic case study investigating mobile learning in an early childhood centre (kindergarten) where mobile devices are being used to actively engage children in the learning environment and support teaching inquiry. The study provides insights into how mobile technology can be embedded into early childhood teaching. Using a qualitative approach, the research involved informal interviews and direct observation of how the teachers at the kindergarten were interacting with the children mediated by the mobile devices. Data was collected through field notes and recordings (photos, audio and video.) In addition, semi-structured interviews were conducted with the teachers and copies of children’s artefacts produced using the devices were collected. The research was framed within the Teaching as Inquiry Cycle (Timperley, Wilson, Barrar & Fung, 2007). This process is guided by evidence from learner and teacher practice, what learners and teachers will do differently, and the impact or shift in learning resulting from different experiences and actions. The study showed that the smart devices had become an embedded part of the kindergarten teaching philosophy as a ubiquitous tool to capture and evaluate children’s learning stories and providing teachers with an opportunity to collaboratively reflect on and support the children’s needs.

The next chapter is “Increasing Learner Interaction in Large-Scale Lectures by Using a Mobile Learning Application” by Katja Lehmann, Matthias Söllner and Jan Marco Leimeister. In this chapter, the authors address the problem of increasing numbers of students in large lectures, leading to decreased interaction and feedback. They present the design, use and evaluation of a mobile learning application aimed at increasing interaction in large-scale lectures. The study applied insights from interaction theory and a focus group workshop. Three types of interaction were identified; Learner-Learner-Interaction, Learner-Lecturer-Interaction and Learner-Content-Interaction. Within these types of interaction, seven important requirements were identified from the literature; learners should be creating learning material collaboratively, discussing amongst each other, receiving and providing feedback, have the possibility to ask questions regarding unclear points, be given content specific assignments and get content specific assignments to discuss. From the subsequent focus group, four priority requirements were further developed: Even in mass settings learners should be able to provide feedback to the lecturer, they should be able to ask questions anonymously, they should create and share true/false-statements about learning content, and lecturers should provide questions to be answered and discussed by the students. For these requirements a mobile application was developed using web components and suitable libraries

to support mobile access. After the application was tested in lectures, a survey of 49 students was used to assess its effectiveness. The results showed that three of the four activating functions in the mobile learning application contributed to interaction in large-scale lectures. While further work is necessary, the system provides a firm foundation for development of an effective tool for increasing interaction in large lecture classes.

The next chapter comes from Brazil, “A Remote Mobile Experiment in Brazilian Public Basic Education” by Giovanni Farias, Priscila Nicolete, Juarez Silva, Marta Cristiano, Simone Bilessimo and Silvio Luz Filho. This chapter explores the use of mobile devices to perform remote experiments in STEM (Science, Technology, Engineering and Mathematics) subjects through the Internet. Using such tools, teachers and students can use remote laboratories, equipped with real experiments, to put in practice theoretical concepts learned in class. The work described in this chapter explores these issues in the Brazilian context where a pilot project aims to explore the use of Mobile Remote Experimentation (MRE) by teachers and students of public high schools in Brazil, using the Remote Experimentation Laboratory (RExLab). The overall project within which this study took place involved 287 teachers and 3,201 students across Physics, Biology, and Mathematics. However this particular study focuses on the subject of Physics in one of the partner schools. Providing remote access to experimental labs is particularly important in Brazil, where only 8% of public schools in the country have suitable science laboratories, and less than half of public schools offer computer labs, and these labs only have, on average, eight computers. Using data gathered from surveys of teachers, the authors used TPACK (Technological Pedagogical Content Knowledge) as a framework for their study (Mishra & Koehler, 2006.) The data obtained in this phase was the precursor to training activities for teachers, including blended learning courses, workshops and lectures to empower and motivate teachers to use and integrate the technology. When the training and content design phases were completed, each teacher received access to the remote labs for teaching purposes, twenty-one tablet computers to distribute among their students in their classroom, technical advice from RExLab members and support from high-school peers, who receive scholarships provided by the project. Although the project was in its early stages when reported, initial teacher feedback suggested that both teacher satisfaction and student performance had benefitted.

“Investigating the Daily Use of Mobile Phones for Local Cultural Subjects in the Malaysian Universities Context” by Shamsul Ariffin looks at the potential for students in Malaysian universities to make use of mobile phones, particularly for studying local cultural subjects such as local history, local culture and national heritage, Malay wood craft, cooking, batik, and education action research. The qualitative study described in the chapter was based on a series of Interviews and focus group discussions. These involved 15 focus groups with 148 students and 15 academics participating from two Malaysian universities. Thematic analysis was then conducted on the data collected using NVivo. The main themes emerging from this study were communication, multimedia usage, and software and hardware for daily use. One problem faced in Malaysia, in common with other non-English speaking countries, is a lack of local cultural content for mobile learning. The chapter highlights that local cultural material is not popular among content developers and that ‘Mat Salleh’ content (a colloquial Malay word referring to English speaking content) is more widely available via mobile phones. The participants were selected from courses in areas related to the local Malay culture, and were questioned both about their general use of mobile devices and how they used them for teaching and learning. The author concludes that, although Malaysian university academics and students could potentially use the multimedia functions of mobile phones to address the challenge of the lack of local content, there was limited awareness of the potential for mobile learning in this context. This leads to the recommendation that, since some students

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already use multimedia functions on their mobile phones, they could reduce the lack of local content by themselves becoming content producers.

The final chapter in the mobile learning section is “Create, Transform, and Share: Empowering Creativity and Self-expression through Mobile Learning” by Maria Ranieri and Isabella Bruni. This chapter explores the potential of mobile learning for creativity in formal and informal contexts of learning with a focus on media production and self-expression. It describes three projects addressing young people and entailing the creation of digital artefacts through mobile devices. The first of these projects addressed podcasting in the classroom, and involved learners both using and creating podcasts. The second project involved geotagging audio content in and out of school to create audio guides during a school trip. The final project discusses mobile storytelling in a project carried out with a number of young people at risk of social exclusion. The authors note how ‘collaborative creativity’ took place in these projects, prompted by a series of learning inputs aimed at supporting the transformation of common and familiar media practices into creative self-expression, innovative media use and creative self-representation. The chapter highlights learners’ and teachers’ perspectives and shows how mobile devices can serve as cultural resources that young people use for meaning making and transforming themselves.

MOBILE AND BLENDED LEARNING CHAPTERS

The section of chapters that integrate aspects of both mobile and blended learning opens with “Journalism and Law 2.0: Collaborative Curriculum Redesign” by Thomas Cochrane, Helen Sissons, Danielle Mulrennan and Vernon Rive. This chapter describes the development of a lecturer Community Of Practice (COP) integrating mobile social media, beginning with journalism staff, and later broadened to include law. The study illustrates how a COP can support pedagogical transformation across different learning contexts. The authors begin this chapter by stating that the initial impetus for their project was a growing realization that traditional journalism was in crisis, in the face of increasing use of social media channels. A participatory action research approach was used for the study, supported by a framework with four stages: the establishment of a supporting community of practice of lecturers, exploring new pedagogies afforded by mobile social media, the implementation of student-generated content and student-generated contexts via mobile social media, and the development of reflective teaching practice enabled by peer-reviewed publication of the project outcomes. The research focused on a series of case studies in journalism and law courses, and how changes had taken place within them during the study. As a result of participating in the community of practice, the lecturers have been empowered to try new approaches to teaching and learning, fostering student-generated content and student-generated contexts. The authors found that nurturing an interdisciplinary community of practice involves significant commitment, but yields creative collaboration in curriculum design, and empowers the exploration of new classroom practices.

The second chapter in this section is “Upgrading a Numerical Methods Course into New Mobile Technologies for Mathematical Education: An Approach Based on Flexibility and Skill Development” by Francisco Delgado-Cepeda. The concern of this chapter is how to continually improve science and engineering education by leveraging emerging educational technologies. The author presents the evolution of educational technology use in a numerical methods course based on the integration of Math and Physics curricula, together with a blended learning approach. The chapter describes the current move-

ment towards a flexible scheme powered by mobile applications. The changes to this course have taken place over several years, and have involved not only the integration of new technologies, such as mobile learning, but changes in how the course is designed, in the balance between blended and face to face evaluation activities. This evolution has made it possible to consider delivering the course in multiple modes, including a purely online option. Part of the change in technology has been to move from a traditional learning management system to a suite of open tools, both mobile and web based. Data analysis in the chapter is based on analytical data available through the various online tools, along with student assessment results. One interesting outcome of moving material into such resources is that there are now formal and informal users of the class resources. While some of the course tools are only available to enrolled students (e.g. a Facebook page) other resources, such as a YouTube channel, are open access, and have attracted many learners who are not enrolled on the course. Another result from the analysis is that online teamwork leads to better student learning than more traditional individual assessment. As the course continues to evolve, building on blended scenarios, online practice and construction of intelligent adaptive tutorials, the author notes that this will require changes in the way that each teacher sees their own role, and each student the way they learn under more self-directed strategies. Thus changes in educational technology are only one aspect of the evolution of course design.

The final chapter in this section is “Mobile Application Development by Students to Support Student Learning” by Sonal Dekhane, Mai Yin Tsoi and Cynthia Johnson. In this chapter the authors discuss how mobile applications can serve two educational purposes; not only to be used by students for learning but also to be created by other students, giving them realistic experience of developing software for end-users. The intention is that software development projects can be used to create a symbiotic, business-like relationship between students enrolled in a software development course and students in other courses (end-users). This chapter discusses the creation of various educational mobile apps, their usability testing results and their effect on student learning. The apps created were in the fields of chemistry and introductory programming. They were written by more senior student studying software development. The authors suggest that the experience of creating these mobile apps for real world users, in teams, gave the students highly relevant experiences that helped to prepare them for future careers in the software industry, as well as providing useful learning tools for other students.

REVIEW CHAPTERS

Review chapters may serve a number of purposes. They may attempt a comprehensive, critical review of the literature, which is a challenging task and would involve analysing many thousands of articles from a wide range of sources. More commonly, they identify a subset of the literature in order to gain insights into a particular publication channel or forum of a research area, or confine themselves to specific subtopics within a research area. One example of analysing a particular publication forum is Wingkvist and Ericsson (2011), which confines its analysis to papers published in multiple proceedings of the World Conference on Mobile and Contextual Learning. In contrast, an example of focusing on a particular subtopic is Viberg and Grönlund (2013) which looked specifically at published research into mobile assisted language learning. Whatever approach literature reviews take, we generally expect that they will give us some insights into areas of research that are well served and those that perhaps warrant further investigation. They may also expose methodological shortcomings that reveal areas where more

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rigorous work is required. On a simpler level they may just provide us with an easy means of becoming familiar with the background and themes of a given research area, for example an overview of mobile learning (Parsons, 2014).

One of the review chapters in this book analyses the relevant work in a particular publication channel, namely the Web of Science database. This chapter is “A Trend Analysis of Mobile Learning” by Onur Ceran, Serçin Karataş, Ülkü Ülker, Nimet Ünsal Köse, Mustafa Kılıç, Ezgi Tosik Gün, Zeynel Tok and Gökçe Akçayır. The aim of this literature review study is to determine trends in mobile learning research between 2010 and 2015. In this chapter, the authors outline the meaning of trend analysis, which refers to the statistically observable change or general orientation of a general movement. In order for an orientation or a tendency to become a trend, it must comprise a certain period of time, repeat itself during this period, be proven statistically, focus on a specific area, be based on data, and have a certain level of consistency. However, trends report only the facts at the time the research is done, and they do not predict the future. Therefore, it is possible to say that trend studies are repeatable. For this trend study, 221 articles were collected from the Web of Science Core Collection database and examined using content analysis. In this analysis, eight criteria were used, namely; research technique, sampling size, sampling level, learning domain, topical domain, data collecting tool, data analysis method and mobile application development approach. The results suggest that the main tendencies under these categories were experimental method; sample sizes of 31-100 people; higher education students; humanities and social sciences domain; learner outcomes topical domain; mixed data collecting tools; mixed analysis methods; and native mobile application development approach. The authors provide extensive discussion around these results, identifying areas where research has clustered and other areas where useful work might be done.

The other common approach to literature reviews is to identify a subtopic of the research area and analyse only the published work addressing that area. An example of this approach is the chapter “Mobile Learning in Science and Mathematics Teaching: A Systematic Review” by Rosiney Almeida and Carlos Araújo Jr. In this chapter, the authors analyze mobile learning literature addressing formal teaching situations in the field of science and mathematics education. The chapter describes a systematic review of relevant literature, investigating work published between 2005 and 2014. The approach taken was based on work by Kitchenham (2004), who conducted systematic reviews in medicine, and Barcelos (2014), who conducted a systematic review of literature on the relationship between computational thought and mathematics. The chapter also provides an overview of previous literature reviews in the mobile learning field. Following these exemplars, the literature review work was executed in three steps, namely: planning, handling and reporting of results. Relevant publications were identified from the SCIELO, ACM Digital Library and ERIC databases. Based on the findings of this review, the results reveal that since 2009 interest in the academic community for research involving m-learning in science and mathematics teaching has intensified. An emphasis on the growing need for research involving m-learning at undergraduate levels is evident. The study notes positive reported results on the impact of m-learning in science and mathematics teaching, notably in assisting ease of learning, promoting student interest and collaborating with positive, motivating attitudes and encouraging meaningful commitment among students in learning activities.

Our final chapter is “Taking advantage of MOOCs in K-12 Education: A Blended Approach” by Helen Crompton and Samantha Briggs. Unlike the other two review chapters, which focus their attention on aspects of mobile learning, this chapter looks at a particular aspect of blended learning, the potential for

MOOCs to be used in conjunction with K12 (ages 4-19 years) classroom education. In this chapter, the authors explore how the recent popularity of Massive Open Online Courses (MOOCs) might transfer into a blended learning context in K-12 education. This chapter provides a review of the literature of early pioneering work of MOOCs in K-12 within North America. Early MOOC classes are explored and positives and challenges discussed. From their discussion, the authors believe that there is a place for MOOCs in blended learning mode in K-12 education to extend and enhance the existing K-12 curricula.

David Parsons

The Mind Lab by Unitec, New Zealand

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