Ann Marcus-Quinn
Tríona Hourigan *Editors*

Handbook for Online Learning Contexts: Digital, Mobile and Open

Policy and Practice

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Preface

To say this book is timely is most certainly an understatement. While digital technologies have created new opportunities and new ways of doing things in so many spheres, their role in education has been contested. In the Irish context, where I have seen various technologies rolled out, rolled back and rolled up over the course of my career, this stems from a complex historical and instructional context, and schools and education institutions here have typically adopted technologies much later than has been the case for many of our European neighbours. Perhaps more significantly, a rush to embed technologies in response to curricular and policy change has meant that these ‘advances’ have not always been effective and, on occasion, have been introduced in the absence of the necessary infrastructural supports, most notably teacher professional development and adequate broadband connections. ‘Putting the cart before the horse’ comes to mind, but more fundamentally, questions over the risks posed by education technology are also necessarily to the fore. These challenges are of course not unique to Ireland and have been aptly captured by the prominent educationalist Diane Ravitch (2017):

> I have seen teachers who use technology to inspire inquiry, research, creativity and excitement. I understand what a powerful tool it is. But it is also fraught with risk, and the tech industry has not done enough to mitigate the risks.

The need for an evidence base to underpin the safe and effective adoption of innovative practices across education levels and systems has never been more important, and this book is very well placed to contribute to that evidence base.

Content, connectivity and context are central in shaping whether and how innovative practices shape the experiences of learners. Wide socio-economic inequalities and variations between countries characterize access to new and progressive technology approaches. The contributions in this book capture a wide range of innovative practices in classrooms and workplaces from around the world. In spanning educational levels and settings, across a diversity of contexts, the authors provide rich and varying insights into the opportunities for innovation, particularly in education, within our increasingly technology-driven society. Renowned educator Andy Hargreaves perhaps best captures the undeniable centrality of technology to educational change in today's world:

> … a new mantra is being spread across the world's governments and through its media. It's called 'reimagining education'. … Its visions of innovative learning are engaging and purposeful. But eventually, the conclusion is drawn that these interests can be best advanced by digital technology. (2020)

The book makes a cogent case that technology has the potential to widen participation in education and to introduce new and sustainable pedagogical practices. The role of technologies and online learning modes to support more reflective and experiential learning, in formal and informal ways, is a particularly important focus. The book offers suggestions on how to create autonomous and independent learning across educational and workplace settings. Some contributors also shine a timely light on the potential to support wider learning opportunities outside the classroom and increase ties with the natural world. The potential role of mobile learning and open educational resources to support students, teachers, and teachers as researchers, are illustrated in a myriad of ways across the book. Key social and educational dilemmas are also addressed, with a particularly important focus on the challenges for students, teachers and workers emanating from the 'always on' technology culture.

Across a fascinating range of chapters spanning varying contexts, this book illustrates how digital technologies have the potential to enhance teaching and learning across different instructional contexts using a wide variety of tools and applications. Each of the 22 chapters manages comprehensiveness, specificity and rigour. In drawing together imaginative thinkers and researchers at the cutting-edge of the field, this gold mine of a book is exceptionally well-placed to stimulate wider dialogue on how best to ensure innovative practices support learners and potential learners, regardless of background or situation. In doing so, perhaps technology in its ever-changing forms can evolve in more socially aware ways.

It seems fitting to conclude with a quote from Sir Ken Robinson, who passed away on 21 August 2020:

> Technology has always intimately engaged with human innovation and creativity...Tools have always done two things… They have extended our reach… But also it extends our minds. It makes us think of things differently… It makes us conceive of things that we couldn't before. (2017)

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Mary Genevieve Billington is an Associate Professor in Mathematics Education at the Norwegian Reading Centre at the University of Stavanger, Norway. Billington has worked as a teacher, a teacher-educator and as a researcher for many years. Her research interests are in the areas of the design and implementation of digital technologies for learning, innovation, adult learning and professional development in education.

Constance Blomgren is an Associate Professor of Education at Athabasca University, Canada's Open University. Her background as a K-12 teacher in rural, remote and northern Canadian locations informs her research and interest in open educational resources and open pedagogy for K-12 teachers and learners. Her research regarding strengthening K-12 teacher awareness and use of Open Educational Resources (OER) and open practices has been published in various journals and book chapters. In addition to researching OER, she studies visual and multi-literacies, participatory technologies, teacher professional learning and open pedagogy. From 2019–2021, she was a Director with Open Education Global; contributing to the development of a culturally responsive OER teacher network.

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Renee M. Filius is Head of Education Affairs at Utrecht University, the Netherlands. She is responsible for managing the policy support of the Executive Board of Utrecht University. She worked for various institutions, including University Medical Center, Utrecht, and the Digital University (currently SURF). She is particularly interested in online education, and more specifically how deep learning can be promoted in this type of education. She has a PhD in this field and has published on how (peer) feedback can promote deep learning in various forms of online education, such as Small Private Online Courses (SPOCS) and Massive Open Online Courses (MOOCs).

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Sushita Gokool-Ramdoo has over 25 years' practitioner experience in areas including workplace training, adult education, women and development issues, regulatory and policy development and quality assurance within the framework of Education for Sustainable Development. She started her career in 1995 with the now Open University of Mauritius where she had been in charge of distance education program development, lecturing, monitoring and evaluation. She subsequently headed the distance education regulatory division of the Tertiary Education Commission, Mauritius, for 13 years where she developed the National Distance Education Policy for Mauritius in 2013. Her research interests are the development and application of distance education theories, in particular the Transactional Distance Theory and the Community of Inquiry in online training projects. She is currently trailblazing workplace online learning for typical and atypical learners while implementing the e-learning architecture of Transinvest Construction Limited. She also offers consulting services to accompany projects whereby pedagogy intersects with technology.

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Chapter 1
Introduction

Ann Marcus-Quinn and Tríona Hourigan

This introduction provides an overview of the chapters presented in this handbook which aims to address the gap in the literature concerning global case studies of successful Open Education. The book shares experiences from a wide variety of contexts in international teaching and learning projects in Open Education. The book provides advice for future policy and investment in digital teaching and learning and Open Education projects. The book also provides case studies that illustrate the expectations regarding the future capacity and sustainability of Open Education.

In Chap. 2, Nasia Kotsiou (University of Cambridge, UK) and Tyler Shores (University of Cambridge, UK) discusses Open Educational Resources (OERs) and the future of digital textbooks. Through a discussion of the current state of OERs, this chapter aims to examine what the future may hold for learners, educators, researchers and publishers.

In Chap. 3, Keith Heggart (Technical University Sydney, Australia), within the context of Open Education, highlights the need to define a professional identity of learning designers in addition to discussing the challenges associated with the de-professionalisation of teaching.

In Chap. 4, Valeria Levratto (Rey Juan Carlos University, Spain) and Sonia Santoveña (National Distance Education University, Spain) describe students' perceptions of the experience of an academic debate on Twitter. This type of research considers pedagogical methods based on social components and network participation.

In Chap. 5, Renée Filius (Utrecht University, The Netherlands) and Sabine Uijl (Utrecht University, The Netherlands) discuss teaching methodologies for scalable online education. This chapter highlights how Small Private Online Courses

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(SPOCs) can make better use of the lessons learned in the field of scalability that Massive Open Online Courses (MOOCs) offer.

In Chap. 6, Kleopatra Nikolopoulu (National and Kapodistrian University of Athens, Greece) looks at the use of mobile devices amongst secondary school students. This chapter discusses the situation in Greek secondary education with regard to mobile devices and mobile learning.

In Chap. 7, Xiaofan He (Xiamen University, China) and David Wray (Professor Emeritus, Centre for Education Studies, University of Warwick, UK) review how learning practices and notions of learning are being updated through the use of mobile devices in the out-of-school learning practices of Chinese secondary school students.

In Chap. 8, Gertrud Lynge Esbensen (Aarhus University, Denmark) and Theresa Schilhab (Aarhus University, Denmark) aim to categorise the technologies children and young people use in what could be considered Open Education situations. They also consider the question of the extent to which informal learning using digital technology contributes to direct experiences with an improved understanding of nature.

Moving on to Chap. 9, Trude Hoel (University of Stavanger, Norway), Margaret Jernes (University of Stavanger, Norway) and Mary Billington (University of Stavanger, Norway) describe and discuss an Open Education Resource, Language Track, designed to support professional development (PD) in Norwegian Early Childhood and Care (ECEC) institutions.

In Chap. 10, Constance Blomgren (Athabasca University, Canada's Open University, Canada) describes a media project of videos and podcasts developed for in service primary and secondary teachers and graduate students. Blomgren presents some future practice and policy suggestions which could provide extensions to the possibility of iterating towards more Open practice.

In Chap. 11, Anna Dabrowski (University of Melbourne, Australia) describes how the teaching profession faces an unprecedented number of challenges in supporting and retaining high-quality teachers. This chapter responds by providing a case study of one such open education initiative, the online Wellbeing Toolkit, which has now been undertaken by more than 7000 educators in Australian schools.

In Chap. 12, Reza Dashtestani (University of Tehran, Iran) highlights mobile learning challenges and perspectives amongst school students. The study reported on in this chapter considers Iranian secondary schools' context regarding the status of mobile leaning and its challenges and barriers.

In Chap. 13, Katsusuke Shigeta (Hokkaido University, Japan), Hiroyuki Sakai (Kyoto University, Japan), Rieko Inaba (Tsuda University, Japan), Yasuhiko Tsuji (Open University of Japan) and Naoshi Hiraoka (Kumamoto University, Japan) discuss the spread of OERs and MOOCs in Asia and present some future perspectives for Open Education practices in Japan.

In Chap. 14, David Longman (MirandaNet, UK) and Sarah Younie (De Montfort University, UK) provide a critical review of the literature and analyse some of the pedagogical claims underlying ML and argue that expectations are not based on robust foundations of theory or experiment.

In Chap. 15, Evrim Baram (Iowa State University, USA) explores how Open Educational Resources (OERs) offer opportunities for pedagogical change through participatory practices in higher education. This chapter presents three cases where open pedagogy was put into practice in a higher education institution. The chapter also presents a set of design guidelines and recommendations for future implementation of renewable assignments.

In Chap. 16, Sushita Gokool-Ramdoo (Mauritius) discusses an innovative tablet-based workplace-learning project. This case study provides a solid theoretical foundation to guide mobile learning (m-learning) for effective competency-based training. This case study demonstrates how by valuing its employees and trusting them with an electronic tablet, the company scaffolded their leap from illiteracy to digital literacy, successfully enabled the acquisition of work-related twenty-first-century competencies, and powered learner autonomy.

In Chap. 17, Charles Mifsud (University of Malta, Malta) outlines the ways in which five teachers in primary classrooms in Malta were prepared to use tablets for the teaching of bilingual literacy, in Maltese and English. They were trained in a blended learning format on topics such as teachers' planning and preparation, the classroom environment and instruction, and professional responsibilities.

In Chap. 18, Christina Preston (Founder of MirandaNet, UK), Alison Hramiak (Sheffield Hallam University, UK) and Sarah Younie (De Montfort University, UK) present a literature review on e-mentoring to identify the main trends in the literature. They also discuss research conducted on online learning by members of the MirandaNet Fellowship, a professional organisation for educators in the UK.

In Chap. 19, Gráinne Walshe (University of Limerick, Ireland) explores considerations regarding the design of digital learning in two very different learning contexts, within the discipline of science. The two case studies illustrate the need for a nuanced approach to the implementation of digital teaching and learning.

In Chap. 20, Eva Hartell (KTH Royal Institute of Technology, Sweden) and Jeff Buckley (Athlone Institute of Technology, Ireland) provide an overview of Comparative Judgement (CJ) as a tool in educational assessment. The chapter describes research studies that highlight the advantages of using digitised content as illustrative examples for formative learning purposes.

In Chap. 21, Tony Hall (National University of Ireland, Galway, Ireland), Marie Ryan· (Mary Immaculate College, Ireland), Jennifer McMahon (University of Limerick, Ireland), Marek McGann (Mary Immaculate College, Ireland), Alison Egan (Marino Institute of Education, Ireland) and Cornelia Connolly (National University of Ireland, Galway, Ireland) describe how best to support teachers to incorporate research into their teaching in a systematic manner.

In Chap. 22, Brendan Mac Mahon (National University of Ireland, Galway, Ireland), Seán Ó Grádaigh (National University of Ireland, Galway, Ireland), Sinéad Ní Ghuidhir (National University of Ireland, Galway, Ireland), Brendán Mac Gearailt (National University of Ireland, Galway, Ireland) and Emer Davitt (National University of Ireland, Galway, Ireland) discuss how the application of remote live technology has transformed the observation of teaching practice and school visits.

In Chap. 23, Caroline Murphy (University of Limerick, Ireland), Ann Marcus-Quinn (University of Limerick, Ireland) and Tríona Hourigan (Department of Education, Ireland) discuss the issue of technostress as an emerging consideration in school cultures post Covid-19. A number of contextual factors are considered amongst the backdrop of a climate that demands more participation from teachers and students in uncharted online spaces.

Overall this publication provides an extensive overview of Open and Digital Education as it is currently understood and practised on a global scale. It is our objective that this book may offer possibilities to explore the potential of Open Education as established by respected practitioners in the field. The chapters in this publication reflect both top-down and bottom-up approaches and are drawn from authentic contexts. As such, this publication presents concrete examples of good practice in this domain from around the world. When working on this book it was essential to capture case studies that offered a diverse range of reported experiences in this area. Without doubt, the arena of digital and Open Education is a contested space and there are many facets to be considered. Covid-19 has accelerated the dialogue around digital education in general across sectoral levels of education and has also impacted work-based and professional training. While the impact of Covid-19 may be seen as the ultimate disruptor, the chapters provided here may offer a guiding framework for remapping how we engage critically with all that the technology can afford us while not relinquishing our educational and cultural values.

Chapter 2
OER and the Future of Digital Textbooks

Athanasia Kotsiou and Tyler Shores

2.1 Introduction

As higher education costs continue to rise at a seemingly unsustainable rate, attention is increasingly turned towards avenues that can help mitigate such alarming financial burdens. The global textbook industry, by some estimates, will exceed $119 billion in the coming years. Digital textbooks have often been pointed to as one of the most promising platforms for large-scale open educational resources (OER). However, the much-foretold digital revolution has thus far manifested in small (albeit successful) projects, usually situated at individual universities. Open access digital textbooks continue to hold a great deal of promise in making available a wealth of online content for educators and learners worldwide, and point towards a possible direction for the still outdated models of the majority of traditional print-only textbook publishers.

Such a shift from a more print-based model to more digital and open content and access also has much larger implications, ranging from learning – not just what students learn, but *how* they learn – to the future of textbooks, the publishing industry, and how educational institutions may structure themselves in the near future. While this chapter focuses on OER use primarily in the USA – as the OER model has been more prevalent in North America – it also discusses OER adoption and attitudes in other parts of the world, such as Africa, Asia, and Europe.

With some university-specific case studies indicating that free access to online learning materials can have a positive effect on learning outcomes, the future of open digital textbooks appears promising. Even more traditional publishers, such as Cambridge University Press, De Gruyter, and Springer, have increasingly moved towards open access as a means to stay relevant in an increasingly crowded and competitive publishing space. Larger scale projects such as OpenStax as well as

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exploratory efforts such as UK Open Textbooks have shown the promise of what the near future of open access education might look like, with OpenStax alone reaching over two million students during the 2017–2018 academic year. As more universities and learning institutions take up the open access model, there could be a sizable shift in the coming years towards increasingly more open educational resources that might fundamentally change the role of textbooks in education. This chapter will survey the current state of open access digital textbooks with an aim to examine what the near future may hold for the ways in which educators, researchers, publishers, and learners use, interact with, and disseminate such resources.

2.2 The Costs and Consequences of Current Textbook Models

Before discussing the effects of OER, it is important to define and contextualise OER in today's education systems. As defined by Creative Commons (Green and Wetzler 2019), a non-profit organisation committed to building a global public commons of knowledge and culture:

> Open Educational Resources (OER) are teaching, learning, and research materials in any medium that reside in the public domain or have been released under an open license that permits no-cost access, adaptation, and redistribution by others.

Universities are increasingly using and expanding OER, which is a direct result of the financial reality that confronts students in the face of rising tuition costs and diminishing employment prospects. A contributing factor of these student burdens is the growing financial strain from coursework materials. With the estimated cost of books and supplies exceeding $1,260 for a US student (Ma et al. 2019), university students appear frustrated and are looking for ways to minimise the costs. In this effort, students often decide not to purchase coursework books on financial grounds (Borchard and Magnuson 2017; Florida Virtual Campus 2019). For instance, a survey with 2,039 students from more than 150 US university campuses found that two in three students (65%) had decided against buying a textbook because it was too expensive (Senack 2014). Interestingly, students knowingly accepted the risk of lower course grades, as an overwhelming 94% admitted that this could hurt their grades. Another common strategy to alleviate the financial burden is reducing the number of courses that students take. As a recent survey across all higher education institutions in Florida has shown, two in five students end up taking fewer courses or even dropping a course (23%; Florida Virtual Campus 2019). Similarly, a Canadian study indicated that over half of the respondents (54%) did not purchase a required textbook at least once and, due to textbook costs, students ended up earning poorer grades (30%), taking fewer courses (27%), or withdrawing from a course (17%; Jhangiani and Jhangiani 2017). Regrettably, the negative impact of textbook costs was disproportionately borne by financially disadvantaged students, including those holding a student loan or working more hours per week (ibid) and thus further increasing the financial inequality between different populations of students. In the European context, students also appear concerned about the escalated course-related costs; a survey commissioned by the UK government has shown 58% of students report that core textbooks should be the responsibility of the higher education institution (Office for Students 2018).

In light of these concerns, the adoption and expansion of OER seems highly promising by serving as a means to alleviate students' financial worries. An important question arises however: can OER actually improve student outcomes? The following sections discuss the effects of OER on learning outcomes as well as student and faculty perceptions and attitudes towards these resources.

2.3 Effects on Learning Outcomes

The literature indicates mixed findings about the impact of OER on academic achievement. In a year-long study conducted by the Virginia State University School of Business, 991 students in nine core courses replaced traditional textbooks with openly licensed books and other digital content (Feldstein et al. 2012). This study found a positive correlation between grades and courses using open textbooks (ibid). More recent studies have also found a positive link between OER adoption and students' academic achievement in an online history course (Grewe and Davis 2017) or 'course throughput rate', as indicated by drop rates, withdrawal rates, and C or better course grades (Hilton et al. 2016).

Further studies, however, contradict those findings. A study with seven different US institutions compared 3,524 students assigned exclusively OER in their courses with 10,819 students using traditional textbooks in these same courses (Robinson 2015). Having employed propensity score matching to minimise the differences between the groups, that study found that students using OER received, on average, lower grades than students with traditional textbooks, after controlling for student- and course-level covariates. Students who used open textbooks, however, appeared to enrol in more credits than their counterparts. These findings were corroborated by an even larger study with 4,909 students in the experimental condition and 11,818 in the control group (Fischer et al. 2015). Similar to Robinson's study (2015), Fischer et al. (2015) found that students in courses using OER enrolled in significantly more credits in the next semester, which, as the authors hypothesised, may be due to cost savings associated with OER. The completion rates and course grades, however, were mixed. Finally, two US studies showed that students performed equally well across five mathematics classes (Hilton et al. 2013) and an introductory psychology course (Nusbaum et al. 2020).

Overall, the links between OER use and achievement are under-researched and most of the studies indicate that students using OER perform equally well or in some cases better than students using traditional textbooks. The lack of consensus in the literature may be due to the several confounding variables, such as course and demographics, and differences in research design, for example, experimental studies as opposed to surveys. As one example, it might be possible that OER can be more beneficial for history or other social sciences courses, where students can easily synthesise information from a variety of sources, compared to subjects such as mathematics or science. As a result, further research is needed to examine the links between OER use and achievement in different course subject areas.

Furthermore, the majority of studies have been conducted in the USA, as the OER model has been largely restricted to North America (Pitt et al. 2019). In contrast, the relevant literature in Europe is limited, potentially due to the fact that often higher education courses in Europe do not require students to buy textbooks. Strikingly, in some countries, such as Greece, state higher education institutions supply textbooks to their undergraduate students for free, funded by taxation (OECD 2019). On the other hand, in the UK context, a survey of 96 UK educators has shown that half of the educators do not expect their students to purchase textbooks (Pitt et al. 2019) perhaps due to the variety of coursework preparation materials, such as journal papers and e-books, lessening the reliance on textbooks directly. Indeed, according to a government survey across full-time students in the UK, an average of £512 was spent on direct course costs such as books, computers, and equipment (Maher et al. 2018), nearly half compared to their US counterparts. Furthermore, financial difficulties for students might be less stark in Europe, since public universities in several European countries, such as Germany or France, charge considerably lower fees than in the USA, while some public universities in countries such as Norway, Denmark, and Greece offer completely free tuition to European nationals. As a result, the lower financial burden of books may account for the lower OER adoption rates, and subsequently research, in Europe. Acknowledging and aiming to address this fragmented and sporadic use of OER in the European context, the ‘Opening up Education’ initiative (European Commission 2013) included measures and proposals towards more open learning environments, such as the launch of a single gateway for OER produced in Europe. Furthermore, workshops with experts organised by the European Commission envisioned that by 2030, adaptable OER in all languages will be abundant, while knowledge and content will be accessible to all for free (Munoz et al. 2013).

2.4 Student Perceptions

Despite the mixed findings on course grades, the aforementioned studies have shown that students who have used OER view these resources in a positive light. Hilton and his colleagues (2013), for example, showed that 83% of students agree that the OER materials adequately supported the work they did in class, while three in four students would recommend these materials to their classmates. Furthermore, in another study, an overwhelming 95% of students agreed that OER materials are ‘easy to use’ and provide access to more up-to-date materials than print textbooks (78%; Feldstein et al. 2012). Concerning the potential for OER use, according to Florida Virtual Campus’s large-scale survey (2019), most respondents were positive and open to using them in the future. Another large US survey showed that four in five students felt they would do significantly better in a course if textbooks were available free online and buying a hard copy was optional (Senack 2014). Although UK Open University's OER Research Hub found that only 39% of students reported that their test scores actually improved, the finding that three in five students felt increased satisfaction with the learning experience thanks to OER is promising (Weller et al. 2015). Clearly, increased student familiarity and satisfaction with OER are important contributing factors, but it is possible that greater OER adoption will in turn lead to more of a focus on learning strategies to further lead towards improved learning outcomes. Providing student access to learning materials is vital, but so too is furnishing them with the skills and knowledge for how best they can make use of those materials.

Overall, students increasingly view OER positively. With students' frustrations revolving around bookstore buy-back, teachers insisting on students having the newest editions, and purchasing textbooks that are rarely used (Martin et al. 2017), OER are viewed as a promising alternative.

2.5 Faculty Perceptions

Faculty staff also appear concerned about escalating textbook-related expenses and are seeking ways to alleviate financial pressures on students. Responses from over 4,000 faculty and department chairpersons in the USA have shown that 61% of participants either strongly agree or agree that the cost of course materials is a serious problem for their students (Seaman and Seaman 2018). Department chairpersons, in particular, overwhelmingly agree that making textbooks less expensive for students would be the most significant improvement to course materials (ibid). Although it is hopeful that faculty awareness of OER has increased, with 46% of faculty now aware of OER compared to 34% three years ago, only 16% of faculty have adopted free or open textbooks (ibid). When asked whether they will use OER in three years' time, only 6% of faculty replied positively, while 32% indicated that they would consider it (ibid). Another study in a large private religious university in the USA showed that an overwhelming majority (90%) of faculty members were open to the notion of using OER as long as they were 'suitable', or at least equal in quality to what they are currently using (Martin et al. 2017). Three in four faculty members indicated that this openness to OER was mainly driven by a desire to help students save money or to alleviate the cost of education.

Faculty members in the UK also appear positive about the potential of OER. As a survey among 96 UK educators indicated, the majority of educators appear open to using them in the future (Pitt et al. 2019). However, four in five (82%) do not currently use open textbooks in their teaching, while nearly half of respondents (47%) were unaware of open textbooks (ibid). Lack of awareness has also been observed in other parts of the world; 43% of Mongolian educators and administrators, for instance, have never heard of OER before (Zagdragchaa and Trotter 2017), while 54% of Nigerian academics and librarians were not aware of their university's participation in an OER initiative (Zaid and Alabi 2020). Another study in the UK has shown that, although only 44% believed that OER use resulted in better test scores for students, two in three educators agreed or strongly agreed that OER increased student satisfaction with the learning experience (Weller et al. 2015). Furthermore, that study showed strong evidence that OER use encourages educators to reflect on their own practice.

2.6 Affordances of OER Textbooks

The benefits from OER are manifold. On the student level, replacing traditional textbooks alleviates financial frustrations and enables all students to have access to quality education. Drawing on information about OER use at more than 4,000 institutions, Allen (2018) estimated that OER have saved students, parents, schools, and governments at least $1 billion. With students increasingly choosing not to purchase textbooks, OER can help them adequately prepare for their courses and potentially encourage them to enrol in more courses. The adaptability of open textbooks as opposed to more traditional print-based texts also represents the ways in which digital textbooks can function as a form of assistive technology, by being better able to adjust to the needs of learners with disabilities (Ellcessor 2014).

At the same time, OER content creators may also benefit from finding wider audiences for their work. Not only may their work receive recognition but they may also obtain feedback on their work. Concerning educators, a key benefit of OER is their adaptability. As a result, educators will be able to compare and use a variety of materials to deliver engaging courses. Furthermore, OER materials tend to be more frequently updated and flexible compared to traditional textbooks, resulting in more up-to-date, customisable content. Given the aforementioned evidence that OER use encourages educators to reflect on their own practice (Weller et al. 2015), these resources may lead to higher quality courses. Finally, OER can facilitate remote learning and distance programmes, which may be a valuable source of funding for institutions – perhaps especially during times when physical access to places of learning is a challenge for educators and students alike.

The potential advantages of more access to learning metrics – pinpointing where and what students are struggling with before exams – can be a valuable source of data to improve learning outcomes. Studies such as Junco and Clem (2015) have provided some insights into how such data from digital textbook analytics can be used and acted upon in beneficial ways. In addition, social reading software such as Hypothesis, an open source platform that facilitates group annotations and communication between student users, are also useful for peer-based learning. In this way, digital textbook platforms can help to facilitate more discussions and social learning, affording more collaborative learning experiences.

In recent years, open source publishing tools such as Pressbooks, which feature a user-friendly blog editor-like interface, have made it easier for educators and authors to produce and edit interactive OER textbooks that go much beyond simple PDF files that characterised many digital textbook efforts during the beginning of the twenty-first century. More widely known applications, such as Apple's iBooks Author and Amazon's Kindle Create, have also helped to significantly lower the barrier for entry of the creation and dissemination of such resources for use in classrooms and beyond. Going forward, one of the most promising aspects of OER textbooks is the ability to function across different platforms and formats so that student access and learning is not restricted to proprietary content controlled by a small number of companies or publishers. In an increasingly digital learning environment, functionality such as text search, copy and paste, and transferring notes and highlighting enables learning to occur beyond the textbook.

2.7 Limitations of OER

While OER in the form of digital textbooks have a number of advantages such as lower cost for students and schools, there are still drawbacks that are part of any decision to integrate such content into curricula. Two factors in particular are often intertwined. One is a question of access – while an increasing number of schools, students, and institutions are turning to digital content and have tablets and computer access, the question of digital access is still a pressing issue for some of the areas that need it most (Wei and Hindman 2011). Another is that for many already overtaxed educators and instructors, the learning curve for how to both find quality content and incorporate it into existing learning systems can be daunting (Grönlund et al. 2018; Petrides et al. 2011).

A number of online textbooks and courses are still only accessible with an active internet connection, which also raises questions of access for populations where continuous access to the internet is not a given; this in turn limits how much good online courseware can do for lower income populations without direct access to devices and internet. In a broader sense, even the ways in which questions of access are conceptualised by educators and policy-makers contribute to the ways in which issues are framed about how best to deal with questions of access. Attention to metaphoric language such as the 'digital divide' has interrogated the sometimes complicated ways that online and offline learning practices occur (Graham 2011).

It should also be emphasised that the move from print-based textbooks to digital texts brings with it a number of questions about trade-offs. One recent educational study explored the differences between comprehension and student perception of ease of use between print and digital textbooks (Singer and Alexander 2017). While the majority of students preferred digital texts and also read faster, comprehension was lower when textbooks were read on screens, with factors such as the disruptive element of scrolling and clicking as possible contributing factors in such comprehension differences. The mechanical elements – tapping, clicking, swiping – of digital navigation have been noted elsewhere (Mangen et al. 2013) and suggest that reading on screen has trade-offs that must be taken into account. Another large-scale survey indicated that four in five students prefer to read course materials in paper format, reporting better focus and retention of information (Mizrachi et al. 2018). When reading in print, students appeared more likely to employ strategies – such as annotating, highlighting, and revisiting course materials – which facilitate metacognitive monitoring of the learning process and, subsequently, improve comprehension (Ben-Yehudah and Eshet-Alkalai 2018; Duke and Pearson 2008). Other researchers like Baron (2013) have shown that when students have indicated clear preferences for print over digital reading, factors such as tangibility of the medium and user interface may lead to further research exploration on how to reconceptualise reading strategies, given changes in the reading medium. There is much research still to be done on the effects of how the print and digital mediums shape the experience of reading.

Another important factor to consider is that reading on screens is tied to multitasking activities and potential distractions (Subrahmanyam et al. 2013), such as checking e-mail or social media notifications. According to one prominent cognitive psychology theory, the cognitive load theory, individuals have a limited processing capacity, and when unnecessary demands are imposed on the cognitive system, such as digital distractions, cognitive load is increased (Sweller 1988; Sweller et al. 2019). If cognitive load becomes too high, learning is hampered (Sweller et al. 2019). In this case, by rapidly switching between the coursework material and other websites, deep understanding of the learning materials might be compromised. Other related research has also indicated that students who transition from print-based reading to more screen-based textbook reading may require additional self-regulation skills to help mitigate multitasking and digital distraction behaviour that require different kinds of digital literacy strategies as well (Dobler 2015). There are increasing indications that some OER and digital textbook content is following the example of private textbook publishers, towards an increasing emphasis on online metrics, adaptive learning, and a more web-based model that goes beyond seemingly redundant extra digital features that traditional publishers had used to maintain their audience base in the previous decades.

E-books, however, still hold great promise and the literature has highlighted the importance of training on how to use them effectively. A usability study demonstrated a need for instruction on simple search strategies, such as spell checking, the limitations of the ‘Ctrl-F’ shortcut (which focuses on seeking out keywords, regardless of the context of the text as a whole), and how to develop search terms that will either broaden or narrow results as needed (Miller et al. 2019). Students who participated in that usability study overwhelmingly reported that they were more likely to use e-books in the future (ibid et al. 2019).

Finally, as already shown, faculty members are often not aware of what exactly OER are (Pitt et al. 2019) and subsequently do not understand the benefits arising from OER use to themselves, their institutions, students, and the wider community. Furthermore, they appear concerned about the quality of those resources (Martin et al. 2017). Given that the transition from traditional practices to OER is time- and effort-intensive, training and support might be essential for a fruitful incorporation of the OER into curricula (McGill 2014).

2.8 Potential Barriers

2.8.1 Funding

A significant barrier to OER adoption is financial. Although private donors, governments, and institutions are increasingly financing OER, those resources are still more prevalent in the USA. A notable moment in the OER movement was the UNESCO Paris OER Declaration in 2012, which 'calls on governments worldwide to openly license publicly funded educational materials for public use' (UNESCO 2012). The following subsections summarise key sources of funding for OER.

2.8.1.1 Private Funding

From as early as 2002, the Hewlett Foundation started funding OER programmes, being one of the first institutions to invest in this field. This foundation offers grants targeted to K-12, postsecondary education, and infrastructure development, and has donated more than $170 million so far (Bliss and Smith 2017). Aiming to promote OER in different countries, the Hewlett Foundation collaborates with UNESCO, which monitors and supports global progress in adopting OER through regional and national workshops (UNESCO n.d.). It also collaborates with the Commonwealth of Learning, an intergovernmental organisation committed to promoting and developing distance education and open learning (Commonwealth of Learning n.d.). Another significant source of financial support has been offered by The Bill and Melinda Gates Foundation, which has funded projects such as the Open Learning Initiative and the University of the People, that is, the world's first tuition-free, non-profit, online academic institution based on the principles of e-learning and coupled with open-source technology and OER (University of the People n.d.).

2.8.1.2 Government Funding

In 2015, the US Department of Education's #GoOpen initiative was launched as a means to support states and districts choosing to transition to the use of openly licensed educational resources to transform teaching and learning (Office of Educational Technology n.d.). Twenty states and 121 districts are currently participating in this initiative (ibid). OER are also widespread in Canada; in 2019, for instance, British Columbia announced a funding of $3.26 million for OER (Caldwell 2019). In the European context, however, there appears to be markedly less emphasis on OER. In the UK, between 2009 and 2012 the Higher Education Funding Council for England invested in the UK Open Educational Resources programme to promote free sharing and reuse of high-quality learning resources worldwide (JISC n.d.). Today, however, little funding is currently available for OER in the UK. Similarly, in Germany, it was only in 2016 that an important step towards OER was taken, with the launch of the nationally funded OERinfo. Compared to the large programmes on digitisation, however, the funding for this project has been considered minimal (Hoosen and Butcher 2019).

2.8.1.3 Institutional Funding

Open Education Global is an important network, which, consisting of hundreds of higher education institutions, aims to support the development and use of open education around the world (Open Education Global n.d.). One of its sustaining members is the Massachusetts Institute of Technology (MIT), whose MIT OpenCourseWare (OCW) offers the materials from 2,400 undergraduate and graduate courses to be used by anyone. This initiative started in 2002 and has fuelled the OpenCourseWare movement, which aims to supply online lectures, readings, and other high-quality educational resources to anyone for free. There are currently several universities offering OpenCourseWare materials, such as the University of Michigan, Carnegie Mellon University, Yale, and Open University. Another major initiative is OpenStax, a non-profit educational initiative based at Rice University, aiming 'to give every student the tools they need to be successful in the classroom' (OpenStax n.d.). OpenStax publishes openly licensed college textbooks, which have been estimated to have saved 9 million students over $830 million since 2012 (Ruth 2019). In Asia, China was one of the first countries to adopt and promote OER, where the China Open Resources for Education was established in 2003; 222 members of this consortium have made available materials from 750 courses (OECD 2007). Finally, in the UK context, the Open University launched the OpenLearn platform in 2006, which currently includes over 900 short courses free of charge.

2.8.2 Copyright and Open Textbooks

Open that allow for the ability to share, reuse, and amend content is a central principle upon which OER are built. Awareness of educators at the secondary and higher education levels about copyrighted textbooks seems to vary, while the awareness of Creative Commons licensing has shown a slow but steady increase over recent years (Seaman and Seaman 2017). Some guiding principles on copyright and what defines successfully 'open' content are outlined by Wiley (2014) in the Five R's (Retain, Revise, Remix, Reuse, Redistribute), which also explains that the initial technical choices about format and editing and sourcing can have longer term repercussions for the open content; open content must be able to evolve along with the platforms that contain it. Examples of governmental efforts to stimulate further growth towards initiatives such as the U.S. Affordable College Textbook Act (2019) have generated a debate about the potential for further OER adoption.

2.8.3 Dissemination and Resource Sharing

One of the strengths of OER is the potential for wide dissemination far beyond geographical boundaries. Beyond private and government funding, the future of OER likely depends on the growth of such communities that can increase awareness and continue to provide an open-source approach to learning and education practices. In one such example, librarians in British Columbia formed a community of practice that allows for greater advocacy of OER materials, knowledge sharing, and faculty outreach and awareness (Smith and Lee 2017). Non-profit organisations such as ISKME (the Institute for the Study of Knowledge Management in Education) and their OER Commons database serve as excellent examples for the kind of far-reaching effects that connected networks of educators and teachers can accomplish together. In addition, international efforts such as SPARC (the Scholarly Publishing and Academic Resources Coalition) show the rapidly growing desire to increase access and awareness of OER best practices, spanning collaborations from North America, Europe, Africa, and Asia. Larger tech companies such as Amazon and the Amazon Inspire platform (Young 2018) have the potential to reach large online audiences, but also sit uneasily between the non-commercial nature of OER and the private business models of such large companies.

2.8.4 Textbooks and Courses

As textbooks become more web-like, another question for the near future is whether textbooks will continue to be conceptualised as textbooks as we currently know them. Following other forms of online content – such as the disaggregation of music content from albums as the unit of purchase to individual songs – digital textbook content may follow a similar model (Bakos and Brynjolfsson 2001). Perhaps of even greater implication, the lines between online textbooks and online courses may continue to become blurred, and it may become harder to distinguish where a textbook as a form of content begins and ends within the context of an online course shaped around that textbook structure.

OpenStax, one of the most prominent providers of OER textbooks, has also in recent years experimented with a blending of their open textbook offerings with a more comprehensive online course called OpenStax Tutor (n.d.). At the time of publication, this program is still in Beta and content primarily consists of Physics, Biology, and Sociology. What such experiments suggest for the near future, however, is a reconceptualisation of how textbook content may become increasingly more interchangeable with online and Massive Open Online Course (MOOC) content. Related to our earlier discussion of content, the question of use and copyright again poses future questions that trouble the relationship of OER material to more commercial kinds of educational content: for example, what happens when openly accessible material under Creative Commons licence is in turn used as part of a paid access online course? These potential ethical concerns have already manifested in a small number of lawsuits between content creators and companies, the outcomes of which are pending.

One of the barriers to more widespread OER digital adoption is where it fits within already existing curricula and plans already being used in classrooms and courses. Traditional publishers such as Pearson and other content providers such as Cengage gravitate towards all-inclusive access models, sometimes referred to as a 'Netflix for textbooks' which would encourage classes and entire institutions to subscribe to large-scale commitments for access to entire catalogues of textbooks.

2.9 Conclusion: Looking Towards the Near Future of OER Textbooks

Textbooks have been traditionally the dominant pedagogical tool in higher education institutions. The financial burden of purchasing textbooks, however, has been increasingly afflicting students. Struggling to cope with these costs, students often decide against buying coursework materials, take fewer courses, or even drop classes. OER have often been considered as a solution to this problem and over the last two decades, private donors and governments have been increasingly funding OER initiatives. Although such initiatives have been spotted worldwide, the OER model is more prevalent in the USA. The higher costs associated with book supplies for the US students compared to other parts of the world might be a key motivating factor for the OER trend in the USA. Both students and faculty members appear to view these resources in a positive light. The adoption rates, however, are low and subsequently the impact of OER use on student outcomes is under-researched. Although there are currently barriers and potential drawbacks to OER use, their affordances are vast and OER hold a tremendous promise for more open education, breaking down financial and accessibility barriers.

The worldwide COVID-19 pandemic during 2020 has shown, with the restriction of access to physical library collections and physical learning spaces, what the near future of OER might look like. With changes to how users and students now access textbooks and learning content, research concerning how best to utilise and disseminate digital educational content best practices feels more pressing than ever before. Our intention in this chapter has been to provide some context of current OER projects and to suggest ways that future research can continue to understand the still changing landscape of learning in an increasingly digital context. Some possible areas to consider include: what might different platforms enable and yet restrict for users of different demographics and levels of accessibility? What barriers still exist in terms of education, policy, and technology that can be explored and worked through in the near future? As publishing models continue to evolve with digital technology, what will incentivise high-quality publications to continue to be created and disseminated? Will an increasingly online educational community mean that an 'economy of sharing' can continue to expand the reach of OER?

The tagline for the SPARC Europe website (n.d.) is an apt closing thought: 'Setting the Default to Open'. Could there be a time in our not so distant future in which OER are the default? What changes to learning and life might this entail for our world's populations? All of these questions are an evolving process. We hope that this chapter will be a bridge between what work has been done with current OER projects and the near future of what might be to come.

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Chapter 3 Formulated Professional Identity of Learning Designers and the Role of Open Education in Maintaining that Identity

Keith Heggart

3.1 Learning Design: A New Name for an Old Field?

While the term 'learning designer' itself has only recently entered the educational lexicon in Australia, that term is merely the latest iteration of a discussion that stretches back at least four decades. During this time, the definition of learning design – and what is meant by someone who practises learning design, howsoever that is defined or named – has been the subject of much conjecture and disagreement, at least in academic circles. Even recently, articles have argued the difference between instructional, educational and learning design (Dalziel et al. 2015; Parchoma et al. 2019). People who work in this field have variously been described as Learning Designers, Educational Designers, Instructional Designers and even Learning Engineers (Wagner 2011; Watters 2019a, b). Rieber (1998) suggested combining the terms into Learning and Instructional Design Technology, something that some tertiary institutions have adapted, employing a number of Learning Design and Technology Specialists (for example, University of Technology Sydney 2017). This chapter will adopt an inclusive definition of learning design, inspired, in part, by Laurillard's (2012) emphasis on learning design as a method to improve pedagogy and offer high-quality student experience. In short, learning design is perceived as a 'methodology for enabling teachers and designers to make more informed decisions' (Conole and Wills 2013, p. 28). This definition has been adopted because it reflects the diversity of the work of teachers, and they are the main focus of the chapter.

These discussions about the history of the field and what constitutes the work of a learning designer are covered in more detail (for example, see Association of Educational Communications and Technology (AECT) 2018; Rieber 1998; Wagner

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2011) in other sources. Nevertheless, these arguments appear to be, for the most part, a concern of academia rather than the professional world, where the terms learning designers and instructional designers are often used interchangeably, alongside related descriptions like e-learning facilitators and online trainers. Certainly, the definitional difficulty faced by learning designers does not appear to have limited the growth of the field, both within the education sectors and more widely. Deloitte (2018) predicts that there will be an average annual growth of Information and Communication Technology (ICT) workers of approximately 2.5%. Of this, a significant amount will be in fields related to learning and development. One of Australia's largest job searching websites, Seek.com.au predicts that jobs in the fields of digital learning and instructional design will grow by almost 30% over the next five years. Within Australia, growth is expected to be 13.6% (n.d.).

This growth is linked to the increasing and increasingly ubiquitous use of technology, especially digital and mobile technologies, to meet the evolving training and educational needs of a range of institutions. While it is important to be mindful of the sometimes unfounded hype that heralds the arrival of any new technological solution (Watters 2019a, b; Weller 2018), it is clear that there is great interest in the opportunities afforded by technology enhanced learning in the workplace and educational settings. The changes within the education sector, specifically, are related to the challenges facing higher education institutions related to increased competition, especially from non-traditional providers. A good example of this is Treehouse (teamtreehouse.com), which offers a 'techdegree' program for aspiring computer developers and programmers. There are also challenges with a changing student population, who are increasingly time-poor, requiring them to fit university study around work and family commitments. This has led to the increasing interest in short courses, microcredentials, online and blended course offerings, all of which are, at least in part, delivered by technological implementations and interventions that are intended to support or even replace face-to-face learning.

More widely within both the corporate and the education sectors, in Australia at least, there is an increasing focus on the role that lifelong learning plays in our lives. The recently released Alice Springs Mparntwe Declaration (Council of Australian Governments Education Council 2019), which sets out the goals for education in all of Australia's states and territories, emphasised the need for more focus on lifelong learning: this is a significant change from previous iterations which focused more on the school-based experience, and is linked to the increasing emphasis governments and corporate actors are placing on ongoing training and development. This is something which is mirrored globally, by the UNESCO Institute for Lifelong Learning (UIL). Although it has a history from the middle of the twentieth century, the UIL has recently sharpened its focus on different forms of ongoing and continuing education. According to their website:

> Taking a holistic and integrated, inter-sectoral and cross-sectoral approach to lifelong learning as the guiding paradigm for twenty-first century education, UIL promotes and supports lifelong learning with a focus on adult learning, continuing education, literacy and non-formal basic education. (UIL 2014)

Finally, it is worth recognising that there is something of a redirection of the purpose of the teacher, especially within schools. Increasingly, teachers are being 're-branded' as 'lead learners' or 'learning advisors'; that is, they are no longer seen solely as subject matter experts (SMEs), but rather as facilitators and 'guides on the side'. This description of teachers is problematic, and there has been a great deal of discussion about the role that expert content knowledge plays in effective teaching and learning practice: a discussion that will continue for some time (Persico et al. 2018).

3.2 Conceptions of Learning Design, Not Learning Designers

In this developing space, there have been thrust a number of different models and processes that seek to explain how a learning designer might effectively construct a learning experience. This interest in the process of instructional design (as it was called then, and in different sectors, still is today) grew out of a post–World War II enthusiasm for standardising instruction in the aims of producing more effective training outcomes. Between 1970 and 2005, more than three dozen models of instructional design were developed (for more on this, see Branch and Dousay 2015). Application of these models helped 'designers simplify the complex reality of instructional design and apply generic components across multiple contexts' (Dousay 2018, p. 272). Perhaps one of the most well known of these models is the ADDIE process, which, according to Branch (2009), forms the basic underlying process of learning or instructional design, regardless of which model is actually used. Other academics and practitioners have further added and developed to the field of knowledge about learning and instructional design. For example, Koehler and Mishra (2008) identified the kinds of knowledge required by educators. The Technological Pedagogical Content Knowledge (TPACK) model identified technical, pedagogical and content knowledge, as well and the interstitial spaces between these fields to explore what teachers need to know in order to be able to design effective learning experiences. Another approach was the development of design layers (Gibbons 2003), which helped designers prioritise concerns encountered during the instructional design process.

These approaches have often focused on adult educational approaches and originally had their roots in behaviourist philosophies of education. As more recent philosophies have developed, including those with an interest in cognition and socio-cultural approaches to learning (Beetham and Sharpe 2007; Conole 2013), different theories about and approaches to learning design have been developed in order to effectively translate these theories about learning into practice within classrooms, whether they are physical spaces or online. A good example of such an approach is Universal Design for Learning (UDL), which was developed by Anne Meyer and David Rose in the 1990s, and sought to conceptualise learning design into a series of interconnected networks: affective (why), recognition (what) and strategic (how) (CAST 2020).

In addition, there has been interest from the formal schooling sector and the higher education sector in learning design, linked to the increasing pressures of accountability and the need to do more with less resources, and the ubiquity of technology within many schools. More recent models have been developed that specifically address the school sector. For example, Understanding by Design (Wiggins and McTighe 1998) and Instructional Design for Teachers (ID4T, Carr-Chellman 2015) focus on helping teachers working in schools to design learning experiences that are underpinned by some of these newer ideas and theories about learning and learning design.

A broader consideration has been the discussion about how best to represent learning designs. In this area, Dalziel et al. (2015) developed the Learning Design Concept Map in an effort to describe the field and depict the influences and contexts that are present in the development of a learning design. This was an effort to describe an 'underlying vision of improving teaching and learning through the development of a descriptive framework' (Dalziel et al. 2015, p. 6). Dalziel et al. are quick to point out that there have been many such representations and metaphors used to attempt to explain learning design. Some of these include the play/act metaphor, the lesson plan and the idea of Learning Design as being similar to musical notation. All of these have strengths and weaknesses, and Dalziel and Dobozy (2015) conclude by suggesting that any representation of learning design will probably be a combination of a range of different metaphors and representations. This is a crucial point, and in the discussion below suggests a new representation – not to replace any other representations – but in an effort to supplement those already in existence and further develop the notion of learning designer.

3.3 Learning Designer as a Professional Identity

One criticism of many of the approaches described above is the focus on the process by which learning is designed, rather than the individual doing the designing. While some models make reference to the kinds of knowledge that a teacher or learning designer might need (TPACK by Mishreh and Kohler, for example), these are limited and incomplete descriptions of the learning designer as a professional individual. A profession is defined by more than what they do; rather there are elements of identity that must also be considered. In this, the work of Trede and Jackson is particularly informative: they describe a deliberate professional as someone who 'makes conscious choices, takes a stance, commits to action, and takes responsibility for the consequences of their actions' (Trede and Jackson 2019, p. 3).

While the models briefly discussed above might describe the process by which a design is formulated, or the knowledges upon which a learning designer might draw to demonstrate their expertise in the process of learning design, the models do not adequately encapsulate the professional identify of a learning designer, and that is a lacuna worth investigating. This gap in the literature that is particularly important for people considering entering the profession of learning design. While fledgling learning designers need to understand how and why people learn, the kinds of tools that they might make use of to aid in that process, and the patterns and representations that they might construct or use as they engage in learning design, they also need to understand the roles that they – as learning designers – will undertake in the process of developing learning design; in other words, how is their professional identity developed and maintained (Tripp 1994)? In short, there is a need for greater clarity around learning designer as a description of a profession. Such clarity will be beneficial not only to new learning designers but also to those working in the field who seek to define what it is they actually do (Rowland 2008). The confusion about what learning designers 'do' is partly the result of the lack of such a definition, and the framework proposed below goes some way to beginning a conversation about such an approach. A fruitful site for examining how this might work is that of school teachers.

As stated previously, the contexts in which learning designers work are diverse. Not all learning designers work in schools, and it would be incorrect to suggest that all teachers are learning designers. Nor is it correct that all teachers are learning designers, in the strictest sense of the definition. Even so, there is significant overlap between the skills required of teachers, especially as related to contemporary educational practices. This is depicted in Fig. 3.1.

However, the profession of teachers is being challenged in many countries around the world (Netolicky et al. 2018), with teachers being categorised as lazy, ineffective and inept. Recognising the way that teachers working in schools enact learning design at levels of significant sophistication in order to design effective educational experiences is a way of resisting the attack on teachers' professionalism; indeed, by making explicit the range of skills that teachers employ when they work as learning designers, it is possible to reinvigorate discussions about the professional skills of teachers, and hence develop a professional identity in which teachers are accorded more respect.

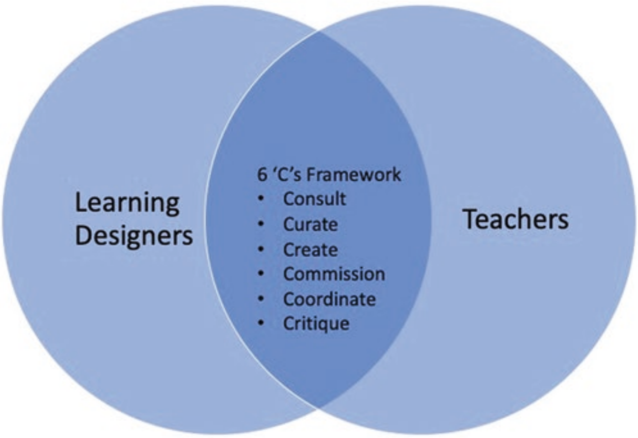

Fig. 3.1 Learning designers and teachers

The profession of teaching is under sustained and continuous attack by a range of sources, often described as the Global Education Reform Movement (GERM). GERM seeks to strip the professional judgement away from teachers, repositioning them as mere deliverers of the curriculum (Sahlberg 2016). This instrumentality limits teachers acting as autonomous or semi-autonomous professionals. Opportunity for professional responsibility and judgement is suppressed, as teachers are required to teach in certain ways, following set lesson plans and using resources dictated and provided by the school or system. In some extreme cases, teachers are told exactly what to say, and how many students to ask precisely worded questions. In such a case, there is no professional freedom, no openness to creativity and no opportunity for teachers to enact their professional expertise. Such approaches betray a fundamental misunderstanding of the complex nature of education and learning (Hager and Beckett 2019), especially in the twenty-first century and, not surprisingly, are a direct assault on the profession of teachers. After all, who needs a highly trained and educated teacher with a four-year degree when all that is required is to follow a script (Adoniou 2016)?

3.4 Recapturing Teacher Identity

What, then, can teachers do in the face of such opposition? The arguments and definitional debates about learning design offer opportunities for those working in schools to recapture their professional identity before it slips away entirely. Such an approach requires not only a consideration of the process of designing learning but also a consideration of the professional identity of the learning designer. To support the latter, a new model of learner designer identity is proposed. By attempting to consider and describe the actions of a learning designer, this model demonstrates the range of expertise that learning designers bring to learning, as well as how they might interact with other experts. This professional identity can also be applied to teachers, and hence strengthen their own professional identity.

The model described below draws from previous models of learning design. Although developed independently, it shares a number of similarities (not least in the name) with Conole's (2015) 7Cs of Learning Design. However, there is a crucial difference in attention that separates this model from other examples extant in the field. As described above, this model seeks to describe what a learning designer (and specifically a teacher) is and does, rather than the process of learning design. This might seem like a semantic difference, but it is an important change of focus that has a number of repercussions, some of which will elaborated on later. Previous models of learning design often seek to set out a process or cycle of learning design. These representations (Dalziel et al. 2015) describe and illuminate what happens when a learning design is created. They usually operate at the level of process, but they do not specifically address the notion of identity. It is this that is important for the proposed framework of learning design. This model is not incompatible with other models of learning design; rather there is great opportunity for complementarity. The difference that this model expresses is that it is trying to describe and encapsulate the identity of a teacher, rather than what a teacher might do when engaging in learning design work.

The purpose behind this activity is an attempt to demonstrate the breadth and width of skills and knowledge employed by teachers on a daily basis. It is also an effort to showcase to initial teacher education students the varieties of ways that teachers act, on a daily, weekly or more long-term basis. It is also a tool for experienced teachers to use to reflect upon their own practice and how they might continue to deliver learning and teaching. And, perhaps most obviously, it is an attempt to push back against those forces that seek to criticise the teaching profession for a lack of intelligence, dedication, professionalism or ability.

3.5 The 6 Cs Framework for the Work of a Learning Designer

The model (Fig. 3.2) is based on 6 'C's which seek to describe the kinds of things that learning designers (and in this case, teachers) do, as part of their professional identity. Each of the 'C's is described in detail below, with reference to how teachers might embrace parts of this framework in their practice in schools.

Learning Designers *consult* Learning designers are not always, or even usually, subject matter experts in the fields they are designing learning. Of course, there are

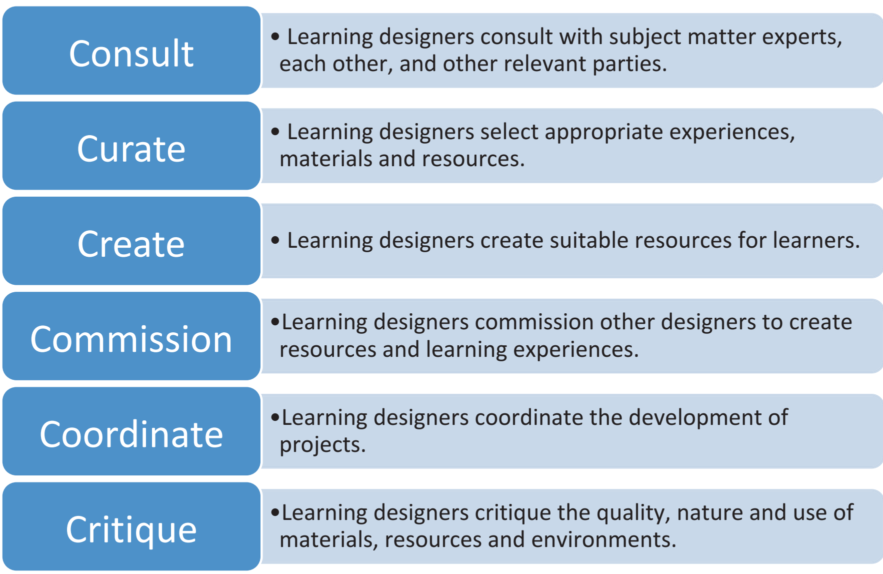

Fig. 3.2 The 6 'C's framework for learning designers

differing levels of expertise, and often teachers are considered to be somewhat experts in their field by virtue of their academic studies, but many learning designers need to – and should – consult with subject matter experts (SMEs) in order to best design learning experiences. The expertise of teachers and learning designers should be in the field of pedagogy, not necessarily subject matter (although such a binary can be problematic in itself). This is a position that is supported by the OECD, who envision

> teachers as designers of learning environments, which focuses on the shift from teachers as technicians who strive to attain the education goals set by the curriculum, to experts in the art and science of teaching. (Paniagua and Istance 2018, p. 13)

This is interesting because there is a great deal of academic discussion about the importance of teacher content knowledge for good teaching and learning. Certainly, in terms of developing expertise, there are some arguments to be made that skills are content-driven, and hence you can't develop generic skills. Regardless of that, learning designers are still required to – and do – consult with a wide range of subject matter experts before they formulate their learning designs. For teachers, this consultation takes place in a range of different ways: they consult with academics (for example, teachers attending sessions given by archaeologists about Pompeii), they consult different sources (both academic and teaching focused resources) and they consult with other teachers (often about different approaches to teaching and learning with their classes). This consultation is important – both because it improves teachers' practice, but equally because it serves as a way that teachers can demonstrate expertise and support within the profession.

Learning Designers *curate* All learning designers are required to curate materials and resources in order to determine which materials best fit with the particular learning context for which they are designing. In the past, where the resources available to teachers and schools were much more limited, this might have been a simpler task. Now, however, in the age of digital and mobile technology, students and teachers have access to a wide range of information. But access to that information is not the same as understanding it, and this is where the professional expertise of the learning designer comes into the equation. As a learning designer, a teacher must identify resources that are suitable to meet the needs of a wide range of learners – many of which will be in the same class as each other. This is a task that is by no means easy. In addition to thinking about the particular level of, for example, a text-based article on the internet, learning designers must consider whether it is accessible through a school system. They must also consider whether the web site hosting the article serves the article in a way that is suitable for students with special needs, such as vision impairment. Learning designers must also consider whether the material is sufficiently engaging for students in their class – or perhaps whether it is too engaging, and risks students becoming distracted. Again, learning designers engaging in these decisions are demonstrating a nuanced and professional understanding of the craft of learning design and the students that they are teaching.

Learning designers *create* Of course, should there be no appropriate material, learning designers can create their own resources. This is an intensely time-consuming process, but that does not mean that learning designers don't do it. Taking the case of teachers, they spend significant amounts of their planning and preparation time devising new resources, such as videos, interactive games and animations. There is a wealth of potential creations, and the considerations described above for curation all apply to creation as well, although there is more fine-grained control over the creation process than there is in curation. Creation is a mediated process; that is, there are a variety of different tools that do some or all of the heavy lifting necessary for the creation of new content, but those resources offer affordances that limit the nature and kind of these resources, and a good learning designer is mindful of these affordances. While there is nothing particularly revolutionary here and many educators have always created their own resources, teachers having the right, and the capability, to create their own resources is central to their expression of their professional identity as learning designers; that is, it is important for teachers are not restricted to using only previously created materials in their design for learning (for example, a proprietary textbook or a learning management system) – they need to be able to alter them as they see fit to meet the needs of the learning environment.

Learning designers *commission* In non-school-based roles, learning designers often end up working in a de facto project management role. This means that they are often required to work with other creative professionals in order to develop learning resources that are suitable. This can be everything from film producers to graphic designers to developers – and it's perhaps not surprising that this kind of role is often confused with the role of learning designers themselves. Much of this is taken up in the next 'c' in the framework (*coordinate*), but the part referred to here is the commissioning of new learning resources and experiences. This might seem to have only limited applicability to teachers working in schools, who are the focus of this discussion, but there is some relevance. In determining how best to meet the educational outcomes, teachers should have the opportunity to determine the kinds of learning experiences – for example, by deciding which subject matter experts might come to the school and do a presentation on life in the Middle Ages for example – or, indeed, even when to decide to commission the involvement of a subject matter expert.

Learning designers *coordinate* As described above, learning designers *coordinate* projects and activities. Firstly, in industry and often with designing e-learning materials, a learning designer might design a course (fully, through consultation and iteration, see 'cycle' below) and then leave it to operate without the further involvement of the learning designer. For example, a learning designer might design a course, write the content and then leave it to run on an as-needed, asynchronous basis, with no further input from the learning designer. In this case, the learning designer coordinated a few working parts, managed a few contributions from key figures and subject matter experts, developed some content, some evaluation materials and an assessment. In this role, the learning designer was like a project manager (admittedly on a very small project). There are, however, other ways of considering learning design. A second example relates to the coordination of synchronous learning experiences. The term facilitation is difficult for some educators, who aren't enthusiastic of the notion of teacher as 'guide on the side', but it is meant here in a much broader sense – as in someone who organises, manages and even directs learning activities. In one sense, all teachers working in schools are coordinators in this fashion.

Learning designers *critique* A final, and often overlooked, facet of learning designers is that they are required to *critique* as part of their work. This is, in the era of GERM and claims about what is and isn't suitable or appropriate educational research, even more important for teachers working in classrooms. Teachers need to be highly critical of new implementations and initiatives, lest they end up drowning under the weight of initiative overload. This aspect is crucially important for teachers working within large organisations; their voices are those of practitioners with an intimate understanding of the way that policy and theory has been translated into practice; as such, they are uniquely placed to voice important questions about practical and ethical issues that have been raised in the course of their work. In many ways, teachers and learning designers need to take on the role of advocates in this respect, speaking out in the interests of students and participants.

3.6 The Role of Open Education in this This Framework

The above framework to think about the work of teachers (not teaching) is important because it strengthens the responsibility and professionalism of the teaching profession. The framework allows teachers to reflect and affirm the diverse roles that they undertake as educators; more importantly, it is an inclusive approach that doesn't seek to confine or limit them to being solely deliverers of pre-defined and pre-constructed learning materials and hence challenges the de-professionalisation of teaching and encourages a professionalisation of learning design as a whole. Instead, teachers are empowered to be creative and critical creators and curators, capable of making decisions based on what they see as being important for their classes, in their profession judgement.

A brief example might help illustrate why this is important. As mentioned earlier, education is becoming increasingly dominated by technology and there are great (and as yet, still controversial) claims about how technology might improve learning. Teachers are increasingly required to make use of technology in a range of different forms in their classrooms via 1:1 iPad or laptop programs. The recent demands for increased Science, Technology Engineering and Mathematics (STEM) education are one such example of this, but it is hardly an isolated case. This is a broadening and developing sphere – technology is no longer restricted to what is happening in classrooms either. Now, technology – and corporate actors – influence all aspects of teaching, and are intensely involved in testing, assessment, administrative and student management tools, learning management systems, online textbooks and learning sources and lots more. In addition, technology-supported communication tools and especially forms of social media are being increasingly used to communicate with parents and other stakeholders – which, while it does have benefits, can also cause significant issues in relation to privacy. The best known of these include Facebook and Instagram. While decision making (for example, about learning management systems (LMSs)) often takes place at a school or even district level, teachers are still capable of either enforcing or resisting these decisions. At a more granular level, teachers still have some authority in the classroom about the kinds of tools that are used and can resist uncritical deployments.

A key battleground in this area is the use of data and assessment apps. For example, in the Australian state of Victoria, public schools make use of an app called Compass. The purpose of Compass is to consolidate information about a child's ability and performance at school and to communicate that information with parents. However, Compass allows the information stored on it to be distributed to third party vendors:

> You retain all of your ownership rights in your content, but you are required to grant us and other users of our Services a limited licence to use, store and copy that content and to distribute and make it available to third parties.
>
> (Compass Education, n.d)

This is a relatively minor example – but it does have significant repercussions – and these repercussions are not often considered at the level of those doing the day-to-day learning design. While governments have indicated that they appear to have little appetite for limiting this 'educational data for sale' approach, I think that teachers can and should resist it in any way they can. However, resisting the pernicious influence of platform capitalism and protecting the privacy of children require teachers and learning designers to have a clear conception of their professional role within society. The framework described above is one part of that. A second part is teachers becoming advocates of Open Education approaches in their classrooms, schools and systems. Wiley (2014) has been a vocal critic of the failure of Massive Open Online Courses (MOOCs) to live up to the promise of being 'open'. In particular, Wiley cites the locked-down and fee-charging nature of many MOOCs that prevent them from being truly open or democratic in nature – and thus, these MOOCs are more 'closed' than 'open'.

Instead, Wiley draws on the Hewlett Foundation's proposal that open means

> teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge (Hewlett Foundation 2014).

According to Wiley, this means that users are free to retain, reuse, revise, remix and redistribute materials. These principles fit neatly with many of the 'c's in the framework described above. In particular, teachers working as *creators, curators and critics* are adjacent to the notion of open education. More importantly, Wiley makes the compelling case that such an approach will increase the quality of teaching and learning by allowing for a more diverse expression of innovation. This is perhaps the most powerful argument for Open Education. Almost every conception of learning design cites the improvement of teaching and learning as being central to their development. Such an improvement is likely to take some innovation or application of solutions to new needs and that innovation is more likely to come from a professional community of teachers and learning designers committed to Open Education than it is from a de-professionalised and isolated group of teachers trapped within walled ecosystems of technology and resources.

3.7 Conclusion

Education is at a critical juncture in many countries. There are significant pressures both external to and within educational systems that are seeking to capitalise on student information and data, as well as the development of learning and assessment resources, tools and infrastructure. In addition, in schools, teachers are increasingly being framed as unprofessional, unaccountable and of poor quality. At the same time, there is increasing corporate and higher education interest in the field of learning design and learning designers, although what is meant by those terms remains unclear.

This juncture provides an opportunity for teachers to use the debate about learning design to reinvigorate a discussion of the importance of their profession. Such a reinvigoration requires a focus not only on the 'what' of learning design but also on the 'who'; that is, the professional identity of learning designers (and teachers). In order to assist this discussion, a model of learner designer professional identity which describes learning designers as consultors, creators, curators, commissioners, critics and coordinators is proposed. Such a framework seeks to add to the already existing definitions of learning design in order to more fully describe the totality of being a learning designer.

This is a necessary first step in reclaiming teacher professional identity, but it is not sufficient in and of itself. Instead, this new professional identity must be bonded with new avenues for those advocating in increasing the spread and strength of teachers' voices. Some of these avenues are currently being explored, by scholars such as Stevenson and Gilliland (2016), who support the combination of industrial and the professional. Teachers are also putting forward diverse views in favour of new approaches: some interesting ideas are encapsulated in the Flip the System movement (Evers and Kneyber 2015; Netolicky et al. 2018).

Such an approach to reinvigorating discussions about the professionalism of teachers is also a powerful argument in favour of open education resources, as opposed to the proprietary systems of educational provision that are present in many schools and systems. Open education requires a commitment to a democratic model of education, with an emphasis on sharing and inclusivity. Such an approach is more likely to encourage innovation, which, in turn, is more likely to lead to improvements in teaching and learning.

Speaking more broadly than just school teachers, the 6 ‘C’s framework takes on more significance in a world that is increasingly taking place online, as a result of the COVID-19 pandemic. Learning designers from all contexts are going to play an important role in designing and delivering educational experiences in these online and blended environments. The 6 ‘C’s framework provides a structure for learning designers to consider their work, but also for subject matter experts and other educators to recognise the breadth and depth of what learning designers do.

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Chapter 4
Connected Learning in Virtual Classrooms for a Master's in Teacher Training at One University in Madrid, Spain

Valeria Levratto and Sonia Santoveña-Casal

4.1 Introduction

E-learning, understood as teaching and learning that takes place in virtual scenarios, is becoming increasingly common in Spanish universities, serving students who need to combine study with work or who can't attend courses in person due to distance. Thanks to virtual teaching, these groups can now participate in interactive classes, working groups and organize their study activities without the limits of space and time imposed by traditional classes (Thoms and Eryilmaz 2014). Since the beginning of the new century, Learning Management Systems (LMS) have allowed the administration, distribution and tracking of online teaching activities. Institutional leaders notice the significance of supporting faculty in their use of instructional technologies including the LMS, with faculty development ranked as the number one key issue in teaching and learning in 2017 (Educause Learning Initiative 2017).

Important areas of research in E-learning include the study of cybersecurity and privacy (among others, Chou et al. 2019), and the study of the ability to differentiate between verifiable information and fake news. Critical thinking is fundamental to the network society, (where fake news spread now more than ever) since it facilitates the acquisition of knowledge and the differentiation between false and true information. In order to respond to new challenges, it is essential to implement activities that facilitate the development of reflective and critical thinking through, for example, academic debates on social media (Garrison et al. 2001; Mercer et al. in press; Santoveña-Casal 2019). Many methodologies used in E-learning platforms are based on the pedagogy of the last century and the major psychological

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paradigms, which, when transferred to digital environments, take on new characteristics. When different media (wikis, social networks, blogs and video-conference) replace the traditional classroom, the design of teaching activities and the flexible application of technological tools become essential for the integration of information technology in education (Ming et al. 2017).

Connected learning is defined as learning which takes place in a hyper-connected context with a network structure. It takes place through the process of connection, through relationships and through the links created both within and outside the educational community. Connected learning uses the potentialities of networks but means more than online learning; it also implies connection between people, with content, with objects, and with ideas, and involves information exchange and distributed knowledge.

The chapter describes connected learning and analyses the results of its use.

The *research questions* of the project were: Is it possible to develop social, practical and network communication skills for future high school teachers with social participation and academic debate on Twitter? Can Twitter benefit the learning process? How do the students interact in a social network learning environment?

4.2 Theoretical Framework: Connected Learning

Studies related to the social network Twitter, within the framework of connected learning, have dealt with different aspects: the idea of Twitter as a space that strengthens the formation of a *communities* with shared interests and *professional learning networks*; its potential as a medium of *social interaction*; and its influence in the learning process during *social participation* online.

The system of connections and shared resources that constitutes an integrated system of participation facilitating learning among professionals is called the Professional Learning Network (PLN) (Trust et al. 2016). It is a broader concept than the social network. In fact, a PLN can incorporate several learning networks or communities (digital or not). The formation of a PLN through Twitter can be achieved through work groups with shared interests that follow a concrete series of hashtags (Prestridge 2019). According to Trust et al. (2016), despite the increase in teaching initiatives in the creation of professional learning networks (PLN), there is a lack of research focused on the results obtained by their application.

These authors found that professional learning networks can support the professional development of teachers. The teachers interviewed for the present study affirmed that the use of these networks offered a different perspective on teaching, facilitated the students' learning, and influenced their own professional identity. Teachers' academic activities using Twitter have been studied by multiple authors (among others, Carpenter and Krutka 2015; Hutchison and Colwell 2012). By studying Twitter as an exchange space between professionals, these authors have shown that the network supports a learning process by facilitating information on teaching experiences and research (Tour 2017; Visser et al. 2014). In addition, it has been observed that its use among teachers has improved teaching practice and understanding of content (Goodyear et al. 2014); the formation of a professional support network and professional participation (Forte et al. 2012); and enhanced the acquisition of technological skills by forming networks with teachers of different experiential degrees (Ertmer et al. 2012).

Twitter has been considered as a tool for the exchange of information (among others, Veletsianos and Navarrete 2012), a space that facilitates students' engagement in the learning process (Jones and Baltzersen 2017a, b; Junco et al. 2010; Liu et al. 2017; Tur and Marin 2015), as well as a medium that facilitates formal academic communication (Dabbagh and Kitsantas 2011) and informal academic communication (Tang and Hew 2017).

With this social network, it is possible to strengthen interaction between the different members of the educational community, not only among students, but also between the students and the teachers (Preston et al. 2015).

In much of the current research Twitter is frequently considered as a *communication space* (De-Marcos et al. 2017; Sobaih et al. Khan 2016; Santoveña 2019). Numerous studies have analysed Twitter's potential to generate conversations and debate (among others, Del Fresno 2014). The study of communication processes in social networks has led to the description of the different message delivery systems by authors such as Kwak et al. (2010). Other research has analysed the general style of communication – such as aggressive, positive or neutral (Veltri 2014) – found in the social network, or the linguistic potential of hashtags (Zappavigna 2011). Other studies highlight just the opposite: the limitations of Twitter as a conversational space. Some authors point out the lack of interaction among users and see Twitter as a space for disseminating information rather than conversation or interaction (Faktor 2013; Lovejoy et al. 2012). Some authors claim that on Twitter users do not argue their opinions, that they engage mainly in monologues rather than dialogues, and that true communication processes do not take place (Lovejoy et al. 2012; Santoveña-Casal 2017; Veltri 2014). The student's role in the context of connected learning implies *social participation* throughout the process, because the student needs to reconstruct new meanings from the different points with which they are connected, whether they are in the form of content, people, ideas, or resources. In the learning process, many variables and elements are involved which directly or indirectly are related to the learning objective. Learning, in short, needs to be understood in a framework of active participation, connections and relationships which goes beyond an institutional design based on an E-learning platform. Connected learning has a different connotation to the notion of learning in the framework of electronic technologies.

In the experience described in this chapter, we use Wenger's concept of social participation understood as "(…) a process consisting in actively participating in the practices of social communities and in building identities in relation to these communities" (2001: 22). The work groups, through spaces such as Twitter, where direct and immediate connections with the educational community (professional and student) are generated, create feelings of cohesion and affiliation that reinforce the constitution of a community of practices with shared interests, as well as the learning process (Santoveña 2019). In recent years, research has advanced in the study of social networks as *spaces of social* cohesion in the academic field. Blight et al. (2017) have found that a positive feeling of community is created among students through the use of Twitter, the process of social interaction and the exchange of information. These processes of social relation have been found to positively influence the development of a sense of community with shared objectives (Blight et al. 2017; Carpenter and Krutka 2015; Mamonov et al. 2016).

Social relations are very important in the performance of university students (Bond et al. 2017; Krasilnikov and Smirnova 2017), and the construction of their own network has a decisive influence on students' learning (Pascarella and Terenzini 2005). It is not possible to talk about a direct relationship between social participation on Twitter and academic performance (Santoveña 2019), but there are data affirming that the participation facilitates learning (Al-Rahmi et al. 2015; Santoveña-Casal and Bernal-Bravo 2019) and provides added value to the educational environment due to its ability to enrich the student's social capital (Jones and Baltzersen 2017a, b; Santoveña 2019).

This chapter analyses the perception and experience that students (future teachers) had while participating in an academic debate through Twitter, and how they consider the contribution of this activity to the learning, communication and interaction process. In addition, we have also studied whether this social participation facilitated a feeling of affiliation and cohesion, as well as the creation of a community with shared interests.

4.3 Description of the Connected Learning Experience

In this first part, the didactic proposal of connected learning based on social participation and academic debate on Twitter is described.

4.3.1 Subject and Student's Profile

The subject "Design and Development of the Curriculum", taught at the Faculty of Education at the National Distance Education University (UNED), is compulsory and common to all students of the University Master's Degree in Teacher Training, a compulsory degree for the practice of teaching in compulsory secondary education and high school, vocational training and language teaching in Spain. This degree enables and prepares students to respond to the specific challenges and situations that will be found in the Secondary Education classroom. The subject "Design and Development of the Curriculum" is taught in the second semester and is worth three ECTS credits (this is equivalent to 75 hours of student work). "Design and Development of the Curriculum" is a compulsory subject of a module that also includes "Learning and Motivating in the Classroom" and "Learning and Teaching" of the subjects of the specialty. These three subjects make up the subject "Learning and Teaching" of the corresponding subjects with a total of 12 ECTS credits corresponding to 300 hours of academic work.

The subject belongs to the area of Teaching and School Organization and provides future teachers both technical resources and theoretical support for the conceptualization of curriculum and teaching. In general, the content of the subject encompasses the variables involved in the teaching-learning process and its relationships; the design of the curriculum; forms of intervention; and evaluation processes and techniques.

The voluntary practical work (Continuous Assessment Test) aims to facilitate the acquisition of knowledge and reinforce the theoretical study of the topics. One of its purposes is to help the student to manage the contents of the subject and to develop practical skills such as participation and collaboration in a network. The social participation and debate on Twitter activity presented in this chapter was designed with this aim in mind.

The work plan consists of a voluntary activity (participation and academic debate on Twitter) and a face-to-face exam. In short, to pass the subject, it is necessary to pass the face-to-face test, which will include all the topics of the programme (from topic 1 to topic 6, both inclusive).

The subject is designed to promote the autonomy of the students through:

- Videoconferences: highlighting contents of the agenda and complementary content.
- Didactic guide: all the general information of the subject that the student needs to know for the task.
- Video tutorials: preparing students for the Twitter-based activity.
- Forums: for each subject of content, mandatory activities, general questions and publication of news.
- Social media: complementary content related to the subject and the topics of debate.

The students taking this subject are future teachers of secondary education who, before starting the programme, have at least 4 years of university education. They are professionals with bachelor degrees corresponding to the specialty they want to study in the master's programme. The students have backgrounds in different disciplines but a common future objective: to be secondary education teachers.

4.3.2 Educational Aims

The general objective of the activity is to introduce students to the use of social networks as a didactic resource within the framework of the curriculum. The main objective is to develop students' ability to process information critically, as well as practical skills that allow them to navigate new communication environments and their use in the classroom.

Through this activity students can experience and resolve the difficulties of an open network educational community and see the possibilities and difficulties of using specific social networks in the educational field in a context of critical thinking.

The aims of the activity are the following:

1. To use Twitter to create an educational community with shared interests in the subject
2. To exchange information and promote debates related to one of the topic of the subject, “The didactic of materials” (i.e the selection of materials and the most relevant topics)
3. To provide students with professional skills for working within a digital environment

4.3.3 Description of Didactical Experience

A volunteer activity, based on connected learning and social participation, was proposed to the students. The main objective was to create a debate on the importance of the analysis and selection of teaching materials for teachers. Lesson n° 5 of the subject is about this activity. To achieve this, the students had to exchange opinions, ideas, suggestions and information of interest related to the subject with their classmates.

The activity consisted of two academic debates that took place on Twitter, both related to the lesson n° 5 of the subject: “The didactic materials”. Students exchanged ideas and resources related to the following topics:

- Debate 1: Are textbooks useful? Should textbooks be used in the classroom?
- Debate 2: What characterizes good teaching materials? What are their most important features?

The activity was carried out for 2 weeks, with one subject of debate per week. Students could join the debate whenever they wanted to if they met the criteria established in their evaluation. Students who do not have previous experience on Twitter must go through a phase of immersion in the social network. A video tutorial adapted to the proposed activity helps them in this process. Students share their Twitter addresses to start forming their own community.

The teaching staff (instructors) send the first debate. From this first tweet, the students link their comments. The teaching staff, over the course of the debate, act as observers. They do not take part in the debate, leaving students free to debate and exchange information amongst themselves. The teaching staff monitor, review the evolution of the debate and download the messages sent by the students.

4.4 Research Methodology

This section presents the results obtained from the future teachers. The authors describe connected learning and analyse the results of its implementation.

The specific aims are:

1. To analyse the experience of the social participation process as perceived by the future teachers during the academic debate on Twitter.
2. To identify the perceived value of the experience from the point of view of the learning process.
3. To study the highlights in relation to the process of communication and interaction.
4. To analyse the generation of a feeling of affiliation and social cohesion, as well as a community of shared interests.
5. To study the messages sent through Twitter.

4.4.1 Research Design and Instrument

The research was based on a mixed, quantitative and qualitative design: a descriptive analysis was carried out with a content analysis of the most significant messages sent by the students throughout the academic debate on Twitter and students' answers to the questionnaire about the activity.

The main instrument for collecting information was an "ad hoc survey", like Likert, which aimed to collect the opinion of students on the academic experience on Twitter.

The data analysis was carried out using three main applications: Excel for data organization; SPSS Statistics version 22 for statistical analysis; and MAXQDA200 as a support tool for content analysis. To collect messages sent through Twitter, Google TAGS spreadsheet v6 (Hawksey 2013) was used.

For content analysis, we carried out:

1. Intensive reading of messages.
2. Identification of the most relevant or significant messages.
3. Establishment of codes and sub-codes.
4. Description of the debates in Twitter.

4.4.2 Research Sample

The activity was carried out by 219 students in a class taught at the Faculty of Education at the National Distance Education University (UNED) in Spain, 47 of whom responded to the evaluation questionnaire after the activity; 53.1% were men and 46.8% women, with an average age of 32.7.

4.4.3 Model of Digital Pedagogy

The connected learning experience was based on a model of student-focused digital virtual pedagogy in an academic environment. Under this model, the teacher guides the learning process and is responsible for ensuring its effectiveness, but the students themselves have the most important role (Rajadell 2001).

The objective of this activity was the development of social, practical and network communication skills for future high school teachers through the use of social participation and academic debate on Twitter. As indicated earlier, the specific objectives of development and evaluation were to create a community and develop a feeling of social belonging in the group of students, and to promote the exchange of information and debate (Fig. 4.1).

The voluntary activity was evaluated on a scale of 1 to 10. A score of 5 or higher, which counted as 10% of the final grade, meant an increase of up to 1 point in the final grade for the class. Each topic of debate was to be treated by the student critically and thoughtfully. At the end of the week, the students described their experience related to each topic of debate, including personal data, as well as the information generated by the rest of the students.

The basic indicators of participation were as follows:

(a) Regarding the debate, students had to provide at least 10 answers for each of the proposed discussion topics. These could include original messages and answers to the opinions of other students. In addition, they had to respond in a critical and thoughtful manner and provide evidence to support their points of view, by predetermined dates, to the messages sent by the teaching team through Twitter.
(b) Regarding the creation of a community, students were to get at least 30 followers, be cited by other Twitter users and have their messages retweeted and marked as "favourites".

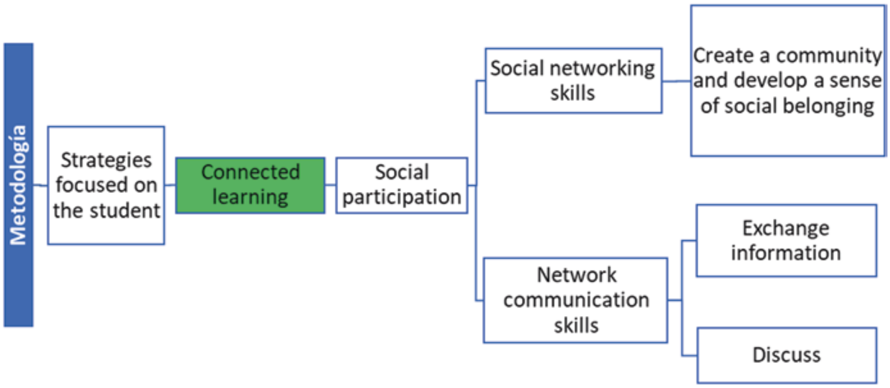

Fig. 4.1 Outline of the connected learning experience

(c) Time-frame of participation: The Twitter activity was to be carried out for at least 2 weeks and messages were to be sent periodically (for example, every 2 days) and gradually over time (that is, not all at once).
(d) The topics were to meet the requirements specified in the activity.

4.5 Data Analysis

To analyse the frequency of participation on Twitter, the general calculation of the tweets sent was made (Table 4.1). During the first discussion topic (# DDC19_1), 4679 tweets were sent, of which an estimated 1002 are retweets and contain 945 links. During the second debate (# DDC19_2), 4407 messages were sent, of which 872 were retweets and contain 863 links. The participation of students on Twitter was analysed with the general label of the subject (# DDC19_UNED). This participation was not subject to evaluation since it was not part of the continuous evaluation activity. A total of 1791 tweets were sent, with 423 links and 387 retweets. There is an average of 30 messages per student sent in the first debate, 28 in the second and 12 tweets with the general hashtag of the subject.

Regarding the *communication process*, students reported that the class had a "high added value" (46.81%), "very high value" (12.77%) and "medium value" (34.04%). When asked about the added value of the media and resources used in the class, specifically Twitter, most students said that it was "high" or "very high" (Fig. 4.2). They said that the added value of the communication and resources used in the class related to the possibilities offered to reflect and debate in social networks was high (38.30%) or very high (31.91%), while 21.28% said that it had a medium value.

Regarding the *interaction process*, it was observed that students maintain a continuous process of communication through Twitter with the rest of the students and, much less frequently, with the teaching staff. Students report that they contacted teachers only very rarely (considering the three interaction variables analysed): to request information regarding the contents, to raise general questions about the subject and to request information related to activities proposals (Fig. 4.3).

Nevertheless, students interacted very frequently with other classmates, mainly through social networks. Above all, they interacted with other students to share general information about the subject; 46.8% do "regularly" and 31.9% frequently.

Table 4.1 Frequency of participation on Twitter

Tweets	#DDC19_1	#DDC19_2	#DDC19_UNED
Number of links	945	863	423
Number of RTs	1002	872	387
Number of Tweets	4685	4414	1797
Total	6632	6149	2607
Average tweets per student	30,28	28,08	11,90

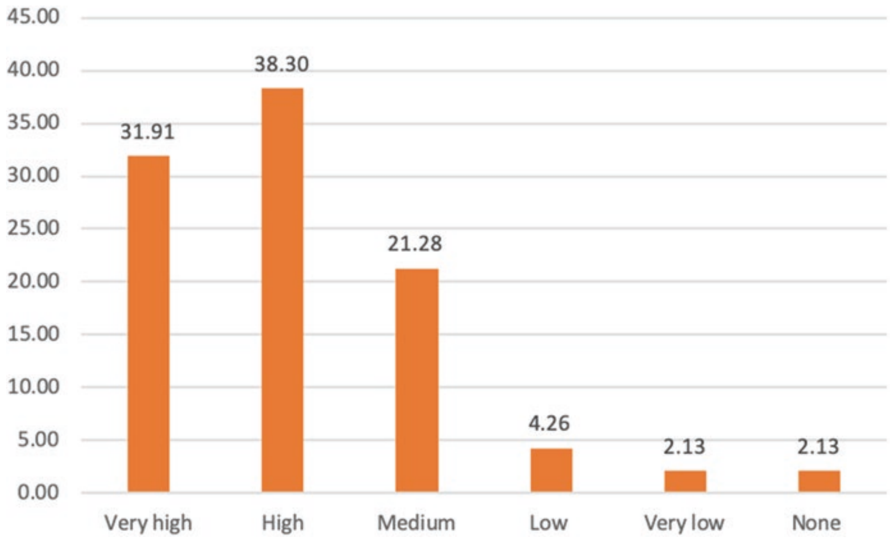

Fig. 4.2 Added value that the media contributed to students' learning (Twitter)

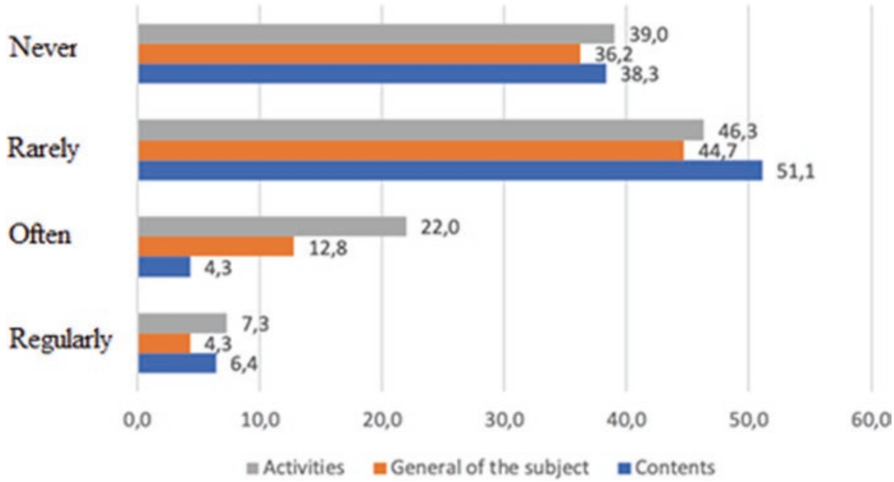

Fig. 4.3 Frequency of student–teacher interaction

They only interacted to a certain frequency with other students to share knowledge, 18% and 7% to request information related to learning problems, and they did so with a certain frequency (Fig. 4.4).

When asked about how communication and interaction with their peers may have improved, students had different perceptions: high and/or very high levels were obtained in the three aspects that were analysed (Fig. 4.5): the students stated that participation on Twitter and the realization of the activity allowed them to

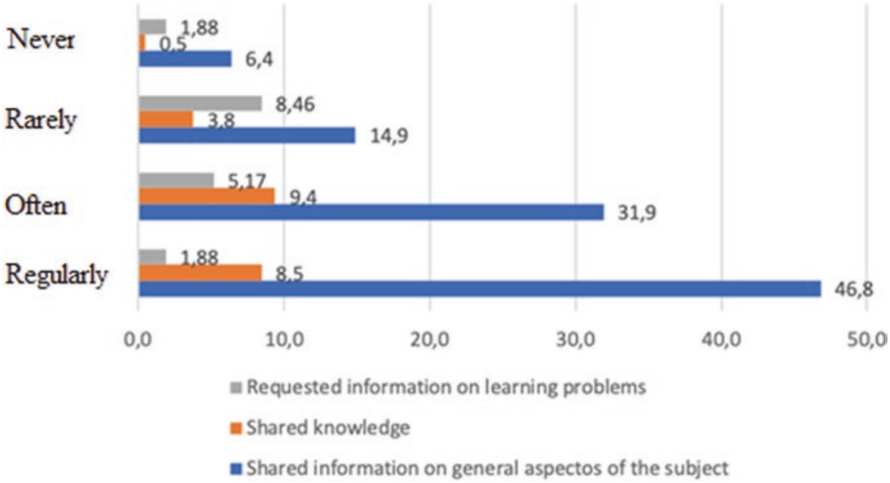

Fig. 4.4 Frequency of students–students interaction

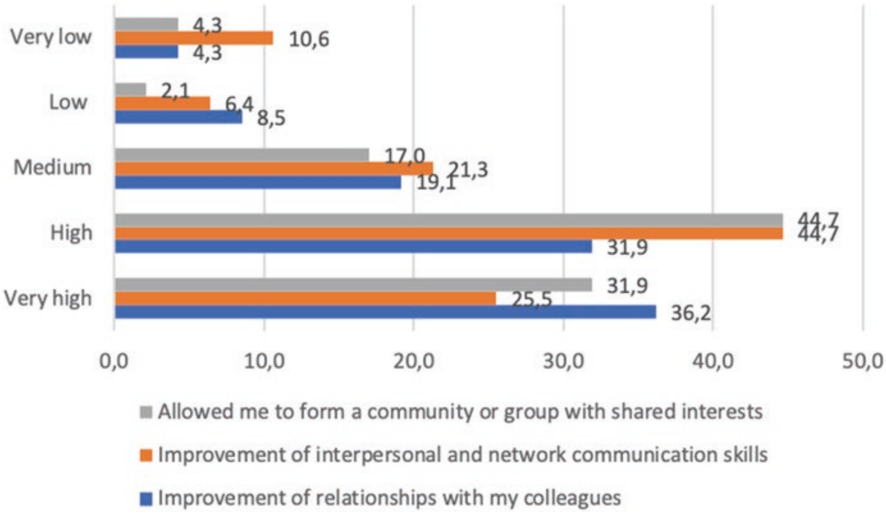

Fig. 4.5 Assessment of the process of interaction and communication in Twitter

improve interpersonal relationships with their classmates (68.1%), improve interpersonal and network communication skills (70.2%) and form a community or group with interests shared (76.6%) (Fig. 4.5).

When asked what *specific aspects of the communicational experience and interaction they found valuable*, the students pointed to the opportunity to interact with peers, exchange ideas and information related to education, build a network and a community with shared career goals and to become familiar with a new tool that is useful for work in education. The communication was fast, agile and friendly, facilitating dialogue. One student pointed out “the participation and interaction that some classmates had with others, debating, while always respecting, different opinions in order to get the most benefit”. Sharing opinions and hearing other students’ points of view allowed them to “have a different view of the subject under discussion”, which enriched the experience.

In general, students reported feeling a sense of belonging with the class group, with 12.77% saying that it was “very high”, 36.17% saying it was “high,” and 31.91% “medium”. Similarly, 36.17% of students reported developing a good relationship with the members of the class at a “high level”, 31.91% at a “medium level” and 12.77 at a “very high” level (Fig. 4.3). In addition, students said that they developed a feeling of belonging with the class group and they felt that their classmates had similar needs and objectives. Of the respondents, 44.68% said that they felt this at a “high” level, 21.28% at a “medium” level and 19.15% at a “very high” level. Only 16.67% said that they had “low” feelings of belonging (Fig. 4.6).

In relation to the *content analysis*, the analysis carried out in each of the debates is presented below:

Debate 1. #DDC19_1 Are textbooks useful? Should textbooks be used in the classroom?

Debate 2. #DDC19_2: What characterizes good teaching materials? What are their most important features?

The codes and sub-codes generated with MAXQDA200 are as follows (Fig. 4.7): The debate focused on the advantages and disadvantages of textbooks.

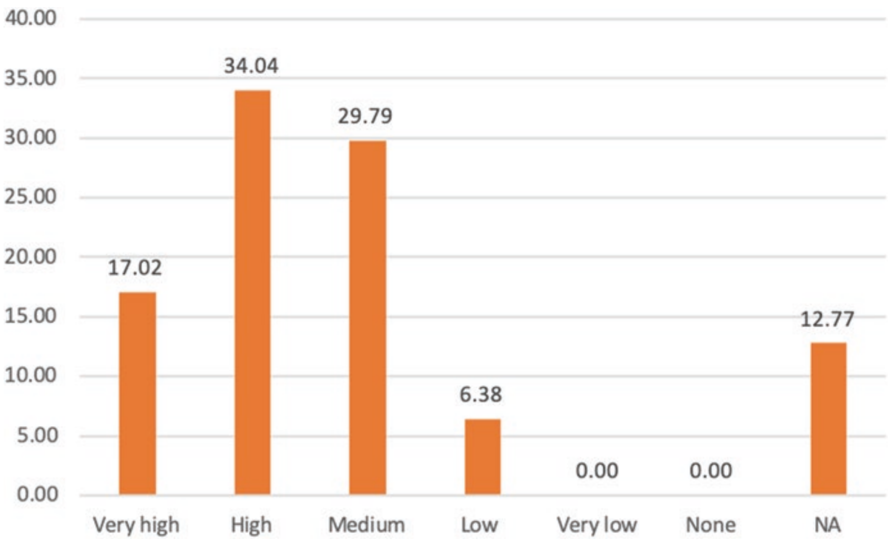

Fig. 4.6 Degree of feeling of belonging developed with the class

Are textbooks useful?	
Book Rejection	
	Innovative Methodologies
Book Acceptance	
	Different resources
	Methodological innovation
	Use
Learning process	
The role of teachers	
	Use/Combination
	Freedom of choice for the teacher
UNED	

Fig. 4.7 The codes and sub-codes in Debate n°1

There seemed to be agreement on the importance of textbooks as a guide that serves to organize the classes and also provides information to teachers. The following tweets appeared in the debate:

> Textbooks, the positive: prepared by experts and according to the curriculum, they are a guide and can be the basis for innovative and versatile classes just like any other material. (1/3) # DDC19_1 (1, Pos. 53)
>
> Textbooks are useful for the teacher to reflect on its content and complement it with the activities or explanations he deems appropriate, ultimately improving the teaching-learning process. # DDC19_1 (1, Pos. 1836)

Students analysed the benefits of textbooks. Most of them were in favour of the use of textbooks, in combination with other resources, rather than as isolated resources:

> There are currently books that are very interactive. In class, they are used with digital whiteboard and offer a lot of possibilities: group work, explanatory videos, activities, flipped classroom, webquests ...we should be open to technology. # DDC19_1 (1, Pos. 53–54)

> (...) it is very important that various tools be used, not just the textbook. A balance between innovative practices and the traditional textbook is essential to contribute to the learning-teaching process # DDC19_1 (1, Pos. 4211)

Other didactic methodologies were considered. This is an aspect of analysis in which students who accepted books and those who tended to reject them agree:

> In short, project learning, combined with digital resources, will be decisive in the future. Of course, we can continue using books, but I think the trend is going to be this. # DDC19_1 (1, Pos. 1025)

> Project-based learning is a very interesting perspective. But is it necessarily at odds with the use of textbooks, even if only as bibliographic recommendations? # DDC19_1 (1, Pos. 2097)

Students tended to analyse the usefulness of the book in the framework of the *learning process*. The combination of resources and good teaching methods form the basis of success in learning:

> And let's complement books with various activities that contribute to learning beyond mere theory ... # DDC19_1 (1, Pos. 802)

Another topic was the *role of teachers* as a guide to learning and the need for the book not to be an imposition on the teacher:

> # DDC19_1 There are indeed teachers who just follow textbooks and that does not favour the teaching-learning process. https://t.co/jh9l5Cp0gO (1, Pos. 3058)

> # DDC19_1 In the new didactic paradigm the teacher is a figure that should guide the student in the learning process and depending on the context the book will be useful or not (1, Pos. 3085)

Those students who argued for *not using textbooks* in the classroom stated that books cut students off from their classmates and made them take a more passive role in their learning. Some also felt that books stifled innovation in teaching.

> # DDC19_1 Textbooks encourage individual versus collaborative learning based on teamwork where students coordinate to obtain relevant information from multiple sources. Do you agree? https://t.co/Cee0wNOJjr (1, Pos. 3277)

They also referred to the work carried out by the UNED in relation to the electronic book. In the students' master's degree, no printed material and textbooks are used; rather, articles, documents and other audio-visual resources prepared specifically for the programme are used. However, students report that even when working with digitalized teaching material, most of the students print it. They ask whether it is a contradiction or a necessity:

> From our own experience as UNED students, we can see how distance education works. I always print notes and summaries to be able to study productively. I find it uncomfortable to study in front of a computer or tablet. # DDC19_1 (1, Pos. 3726)

Debate 2. #DDC19_2 What characterizes good teaching materials? What are their most important features?

The codes and sub-codes generated with MAXQDA200 are as follows (Fig. 4.8):

In the second debate, students discussed the idea that educational resources are tools whose role is to mediate between knowledge and skills, and between the student and the educator. In the digital era, didactic materials have different characteristics, since we now have paper and digital resources that offer students a broader range of experiences. This multimedia material should, according to future teachers,

What characterizes good teaching materials? What are their most important features?
Teacher paper
Mediator
Characteristics teaching material
Versatility
Adequacy
Motivation Emotions

Fig. 4.8 The codes and sub-codes in Debate n°2

have some key characteristics: *versatility*, *adequacy* and the ability to *foster motivation* and *emotions*.

Regarding the *versatility* among different subjects, some students argue:

> I like the characteristic of versatility and I think that it is one of the most important since good teaching material should create a base and help to reach more complex concepts linked to other concepts and with the same base # DDC19_2

Versatility is something that students missed in the Spanish education system:

> # DDC19_2 I think this article, rather than talking about teaching resources, speaks of a new educational system. I love the Finnish system, however, in Spain we are very far from it. It is true that the system divided into subjects limits and makes versatility difficult.

Regarding the *adaptation to the context*, the group agreed that good materials should consider the psycho-evolutionary characteristics of the students to whom they are addressed (cognitive development, abilities, interests, needs, etc.)

> # DDC19_2. If the materials are not designed specifically for a group of students and their situation and level, they will have trouble developing the skills they seek to foster.

When the debate focused on the student–teacher relationship, *motivation* came up as one of the most important points. Future teachers were aware of its importance for ensuring students' autonomy and their involvement in the learning process. The following tweets appeared in the debate:

> # DDC19_2 Gamification tells us that they learn more this way. But I think the important thing is that learning is meaningful, that it motivates them, motivation is the basis of learning

> # DDC19_UNED # DDC19_2. The intrinsic motivation that comes from recognizing the value and usefulness of knowledge is what drives students to work autonomously

When the debate reaches the *field of emotions*, many students identified them as a "didactic resource" and reported that they influenced their importance for learning:

> # DDC19_2 If the teacher is capable of provoking emotion, the battle is already half won, since this favours empathy. It is not just feeling passion for what is taught; in order for it to have the desired effect, one must know how to communicate.

The debate about emotions as a resource was enthusiastic, as shown by this comment:

> # DDC19_2 What an interesting reflection! The truth is, I wasn't raised to understand emotion as a teaching resource Thank you for sharing this news!

In the debate, the role of the *teacher as a mediator* between the material and the students emerged:

> # DDC19_2 In accordance with everything and we must also consider the essential role of the teacher as an evaluator and mediator between material and students

4.6 Conclusions

The use of a model based on connected social learning allows for the creation of a network of contacts or a community with shared interests. These results are consistent with those found by authors such as Carpenter and Krutka (2015) and Mamonov et al. (2016). The students developed a strong feeling of belonging through the activity in the social network, both because they perceived themselves to be part of the class group, and also because they perceived that other members of the group had similar needs and objectives. These aspects are fundamental for the full development of a distance learning process centred on students using the principles of connected learning.

Students involved in the activity appreciated interacting and exchanging knowledge with other master's degree students in education, and also gaining familiarity with a new work tool. Consistent with the findings of Blight et al. (2017), through Twitter, it was possible to reinforce processes of social interaction and generate patterns of information exchange that facilitated the creation of a positive feeling of community among students.

In this experience, the potential of Twitter as a PLN has been observed: future teachers have created a group with shared interests and, through a set of concrete hashtags, have exchanged resources and ideas, thus meeting Prestridge's (2019) description of a PLN. Sharing ideas, resources and perspectives provided students an experiential learning framework among professionals, as observed in research previously analysed by Tour (2017),Visser at al. (2014).

There was an overlap between the community generated as a space for social participation and the learning community, set up by a group of professionals who develop a collective learning process, in line with Wenger (2001). Other authors, such as Santoveña (2019), highlight that facilitating social participation processes through spaces such as Twitter leads to a feeling of cohesion and affiliation that reinforces the forming of a community of practices with shared interests. Interest in the activity was very strong, as the high average participation in the debates shows: the analysis of the calculation of messages sent, as well as retweets and shared links, shows that the use of Twitter during the activity was very intense. Students sent an average of 70 messages throughout the academic year: messages sent to the mandatory debates to overcome the activity (debate 1 and debate 2) or voluntary messages to participate in the general hashtag of the subject.

Students felt that they were able to carry out real debate among their classmates on Twitter, which they valued highly as a contributor to the process of communication and reflection. These results are different from those found by authors such as and Veltri (2014), who believe that true communication processes do not take place on Twitter. It is possible that this difference is due to the intentionality of the proposed debate. In other studies, such as the one carried out by Santoveña-Casal (2017), the selection of a sample of Twitter users was based on a hashtag and not on the analysis of the results obtained based on a debate proposed in advance. Since

Twitter's automatic response processes (retweet, 'Like') can encourage a tendency to respond thoughtlessly, it is essential to design activities where the topics of debate (academic content), as well as the evaluation criteria, are prepared in advance. The combination of the academic and the social is essential to the success of connected learning activities.

In general, in an environment like Twitter, students prefer to interact with their classmates rather than with the teacher. The system of distance education and the design of the class does not reinforce a process of communication and interaction with students. This may be due to the inaccessibility of teachers, lack of motivation on the part of students or the fact that students find enough information through the resources offered (forums, guides, video classes, etc.). The reasons why students do not interact more with teachers would merit further research. More than 50% of the students regularly interact with other students in order to share information related to the subject. These data are consistent with the academic debate activity on Twitter which, among other objectives, sought to share information and resources of interest related to the subject.

Few students interacted with other students to share knowledge (only 18% do so frequently) or to request information related to learning problems (only 7% do so frequently). It is possible that the activity should be modified to encourage the sharing of knowledge. A possible solution would be to divide the class into subgroups, so that each subgroup has a specific research and documentation objective that they ultimately share with the rest of the students.

Students have assessed the potential of Twitter and the activity proposed as the opportunity to improve the process of communication and interaction with their peers. Twitter gave them the opportunity to improve interpersonal and network communication skills and to improve interpersonal relationships with their peers.

The analysis of the content of the tweets of both debates has shown that students analyse the proposed topics deeply and from a variety of perspectives. In the first debate, the importance of the textbook as a medium was highlighted within the context of other variables within the learning process: resources, methodologies, and the teacher's role, among others. In the second debate, the characteristics of good teaching materials are described: applicability to different subjects, adequacy to the context and the ability to generate motivation and emotions. In short, connected learning activities based on social networks can facilitate a process of social learning if they include an academic foundation and are guided by pedagogical criteria.

The main contribution of this study to the scientific field is to share the results of the implementation of innovative digital pedagogical activities involving the development of a process of social participation based on connected learning. This type of study facilitates the implementation at the university level of pedagogical activities based on social components and network participation, which are gaining importance in an increasingly flexible, open and participatory educational system.

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Chapter 5
Teaching Methodologies for Scalable Online Education

Renee M. Filius and Sabine G. Uijl

5.1 Introduction

Higher education institutions aim for students all over the world to be able to follow education. Due to globalisation, higher education needs to be prepared to deliver education to a worldwide audience. Online education makes education accessible to people who might not otherwise have had access to it. It therefore offers many opportunities to reach a very diverse group of students. It also offers opportunities to reach a much larger group of students at the same time since there are no physical constraints to group sizes. Diversity and scalability are both major advantages of online education, compared to face-to-face education. However, the availability of teachers – both lecturers and teaching assistants – may limit the scalability. Therefore, we need to bear in mind that this means that online education demands different didactics, or teaching methodologies, in comparison to face-to-face education. If this is not considered, it will be at the expense of the quality that higher education must provide. Being a relatively new field of research, many didactics that are suitable for online education are not yet commonly known or tried out by teachers (Garrison and Kanuka 2004; Salmon 2012; Filius et al. 2018a). Examples are the use of (audio) peer feedback (Filius et al. 2019), concepts maps (Hay 2007), podcasting (Pegrum et al. 2014) and online debates.

Professional development aiming at teachers designing and teaching online education is still a new field and not yet common practice. Moreover, the teachers designing and delivering online education often have little experience with online education themselves. Many institutions do, however, expect that these teachers be able to design and deliver online education, even without any prior training. With the growing number of students learning online, it is important that teachers become

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familiar with the different pedagogies that are required by scalable higher education online.

Therefore, in this chapter, we discuss pedagogies in online open higher education. In doing so, we focus on a specific form of online education: Small Private Online Courses (SPOCs) and the extent to which this specific form can promote deep learning approaches.

5.2 Deep Learning Approaches

Higher education institutions want to offer education to many students at the same time without compromising on quality. Specifically in the higher education field, this quality is largely determined by the extent to which students are encouraged to choose a deep learning approach (Biggs 1999; Entwistle and Tait 1990). Deep learning is part of a continuum with surface learning. Where a surface learning approach is characterised by, for example, memorising with the aim to reproduce for a test or exam, deep learning is aimed towards understanding and constructing meaning (Aharony 2006; Biggs 1999; Hall et al. 2004; Ramsden and Entwistle 1983; Marton and Säljö 1984). Deep learning therefore involves critical thinking, integration of the new learning material with what the student already knows and creating new connections (Filius et al. 2018a). It is a challenge for teachers to encourage these aspects of deep learning in online education, especially when students are in different locations and time zones. One of the aspects threatening deep learning is that the necessary interaction in online education is often asynchronous without visual cues and body language. Consequently, teachers find it harder to select appropriate learning activities (Garrison and Kanuka 2004; Uribe and Vaughan 2017).

5.3 Social Cohesion and Personal Commitment

To learn deeply in online education, strengthening of social cohesion and personal commitment are crucial, as previous research (Filius et al. 2019; O'Shea et al. 2015) has shown. For teachers, interaction is essential in order to create social cohesion and personal commitment, (Filius et al. 2018b; Uijl et al. 2017). The study by Uijl et al. shows, among other things, that in online education, interaction is of great importance and, when facilitated, takes place on a large scale. In this study, interaction was facilitated by discussion forums for each learning activity, including a more general discussion forum for the course. For certain learning activities, students were required to initiate a discussion and to react to their peers. The interaction concerns not only substantive, but also social interaction. This study, performed in graduate education, showed that there was no difference in student results compared to the course in the on-campus classroom with the same final qualifications (Uijl et al. 2017), implying that deep learning took place.

But even though teachers – rightfully so – view interaction as essential to deep learning, given the high student–staff ratio and the limits to written and asynchronous communication, it can be difficult for the teacher to engage in dialogue with students. Thus, teachers look for alternative methodologies to create social cohesion and personal commitment, that are efficient and effective and less time-consuming (Allan and Bentley 2012). SPOCs (Fox 2013) could represent a type of online learning for higher education that has the potential to promote deep learning because of the small group size and the possibilities for community building and interaction, which may facilitate deep learning, as shown in the study by Uijl et al. (2017).

5.4 SPOCs

SPOCs are a specific form of online education that has rapidly grown in the last decade. SPOC stands for Small Private Online Courses and represents a specific, defined form of fully online education. In addition to the common self-paced and often non-moderated online courses, new forms of online courses such as Massive Open Online Courses (MOOCs) and SPOCs are increasingly popular. SPOCs often have class sizes of about 15–20 students, which enable students to interact with their teachers one-on-one and with each other, for example, by facilitation of peer interaction. SPOCs have a fixed start and end date and usually have entry requirements. Therefore, the students in a group follow the same course time period and start with a similar entry requirements. This combination fosters a sense of community within the student group. In contrast to face-to-face education, most of the learning still takes place asynchronously, allowing flexibility for students with busy schedules and who may live in different time zones. Moreover, in a SPOC concept, more groups can run parallel, increasing the scalability of this form of education without losing the quality required for deep learning.

Table 5.1 shows the distinctive characteristics of both SPOCs and MOOCs. In comparison with MOOCs, SPOCs have a much smaller number of students per course and involve more teacher guidance. Furthermore, all students usually start the course with the intention to complete it, which results in high retention rates of

Table 5.1 Different forms of online education (Filius et al. 2018a)

Forms of online education	SPOCs	MOOCs	Self-paced often non-moderated
Characteristics:			
Number enrolments	Small (15–20)	Massive (up to 10,000)	Small (1)
Teacher guidance	Much	Little	Differs
Peer interaction	Much	Much	Little
Fixed dates	Available	Available	No
Retention rate	High >90%	Low <10%	Unknown

Table 5.2 *Examples of advantages of SPOCs*

Characteristics	Consequences	Facilitates
Small number enrolments	Personal relations amongst students	Social cohesion
Intensive teacher guidance	Personal relations between teacher and students	Deep learning & social cohesion
Much peer interaction	Personal relations & necessity to be active and think critically	Deep learning & social cohesion
Fixed dates	Clarity on expectations	Personal relations
High retention rate	Consistency in group and group work	Social cohesion

over 90% (Uijl et al. 2017). This contrasts with MOOCs, where courses are usually free and students often choose to follow only the parts that interest them or even enrol out of curiosity without ever actually participating (Koller 2013). This causes retention rates of about 6.5% (Jordan 2014).

Unlike face-to-face education, it is tangibly clear within the digital learning environment who contributes and who does not contribute to discussions or other work forms. If an active contribution is expected from students, this visibility has a motivating effect and can help instructors to address students who try to evade discussions and group assignments. The opportunity to 'lurk' as in regular education can therefore be minimised. Table 5.2 shows the aforementioned advantages of SPOCS.

Because of these characteristics (small group sizes, possibilities for community building and interaction), SPOCs may be the type of online learning for higher education that have good potential to promote deep learning. However, compared to face-to-face education, there are still differences that may lead to changes with respect to how deep learning is promoted. In SPOCs, interaction is usually asynchronous, and in most cases, it is restricted to written interaction. Compared to face-to-face education, it lacks visual cues and body language, which are an important part of human interaction. Implementation of these features is difficult in online education. Therefore, online education needs different methodologies other than face-to-face education. We need to re-invent didactic tools for online education and only then can digital learning assume an equal role within the higher education sector.

5.5 Didactics in SPOCs

Didactics that combine the current small-scale teaching methods (aiming for social cohesion and personal commitment) with the large-scale teaching methods (aiming for knowledge transfer) are needed. Examples of these teaching methods are shown in Table 5.3. Table 5.3 distinguishes between teaching methods for small-scale and large-scale online education. These reflect examples of teaching methods that best suit either a small-scale or a large-scale audience. All teaching approaches mentioned can be used in a small-scale online setting. The methods categorised as

Table 5.3 Examples of teaching methods suited for small-scale and large-scale online educations

Small-scale:	Large-scale:
Collaboration assignments	Knowledge clips
Online debates	Assignment instructions
Online student presentations	Readings
Essays/personal narratives	Assessments
Peer feedback	
Role play	
Dialogues on statements	
Concept maps	
Constructing graphic organisers	

large-scale can also be used in a small-scale setting, without losing quality, making it thus more cost-effective. Therefore, there is no clear-cut distinction between small- and large-scale teaching methods.

The aforementioned examples here are not always necessarily conducted in a written form. Video and audio can be used for almost all forms of small-scale teaching methods; especially in interaction and assignments, this may increase the involvement of students. It also introduces adherence to students' preferences in interaction and assignment work. Usually, at the end of each SPOC, students take an assessment. Assessments can be taken in different forms; an essay, a presentation, a debate or by means of the individual's contribution to group work. When the assessment is taken by means of open and/or multiple-choice questions, an online proctor is often used to check the identity of students and to supervise them.

In SPOCs, it is possible to combine both large-scale and small-scale teaching methods. When running different course groups in a parallel manner, it is possible to combine these for the purposes of large-scale teaching methods. This makes for a more efficient use of resources and reduces teacher workload. When combining these two types of learning methods, each student should preferably be part of a small group, which strengthens social cohesion. This small group may have a maximum of approximately 20–25 students, in line with best practice recommended by Arbaugh and Benbunan-Finch (2005) and Rovai (2007).

Of course, making a learning community is not just dependent on the group size. Students need to actively participate in small-scale teaching methods within their own small group. With an easy-to-operate dashboard provided by the virtual learning environment and pedagogical support provided by teaching assistants, a teacher may be able to facilitate up to 100 small parallel groups. With assistants, we mean either a teaching assistant and/ or e-moderators. However, artificial intelligence assistance, a rapidly emerging development in education technology, may also be a future possibility. As witnessed with the established methods, the key to successful scalable online education is in the design. As the number of students increases, the optimal course design and the proper use of large-scale teaching methods are necessary to ensure that the teacher workload will not increase.

The aforementioned teaching methods are under continuous development and following the speed of technical developments in education, it is difficult for teachers to keep up. Outside of teaching duties, teachers are expected to keep up with the content of what they teach, either by doing research or attending CPD events. Higher education institutes should therefore facilitate teachers in the implementation of online learning. An example of how to organise this is the university-wide programme Educate-it at Utrecht University (https://educate-it.uu.nl/en/). The programme offers practical and technical support for teachers with the use of IT tools that have proved their educational value. It also offers practical and technical support for teachers to (re)design their courses by incorporating principles of blended and online learning. The programme also has an academy offering workshops and training on blended and online education, without cost for all teachers within the institute.

5.6 Hands-on Advice – Four Tips for Teachers

In this section, we give some hands-on advice for teachers who design and/ or teach online courses. These tips are from one of our studies: defining teacher challenges for achieving deep learning in SPOCs (Filius et al. 2018a). This advice is also applicable for blended education, combining face-to-face education with online teaching methods. Most of the guidelines are aimed at the design phase of the online education. As already mentioned, a design aimed at scalable online education, enabling deep learning, is key in successful online higher education (Table 5.4).

5.6.1 Aligning Learning Activities and Assessments

If you want students to achieve deep learning, it is important that the teaching methods aim for deep learning and are aligned with the learning objectives and the assessments. This stimulates the students to actively participate; moreover, it challenges students aiming for surface learning (learning to pass the assessment) to apply deep learning methods. An example is an assignment to design a charging

Table 5.4 Four tips for teachers

1 Aligning learning activities and assessments Make sure that both your learning activities and assessment are aligned to each other and to deep learning	*3 Dialogue creation* Facilitate interaction by asking open questions and asking for reactions to (peer) feedback. This stimulates critical thinking and deep learning
2 Insight into students' needs Make sure that you know what your students' needs are before and during the course, in order to be able to prompt them towards deep learning. Peer feedback is a powerful tool for this	*4 Social cohesion* Create both a personal relationship with your students and a personal relationship amongst the students to create social cohesion leading to deep learning

pole for electric cars. Students are asked to apply electrotechnical laws, but also take user-friendliness into account. By designing the assignment this way, the students are forced to automatically establish relationships, structure information, think critically and use learning material. It is important to create room and time for trial and error; let the students interact with the learning material themselves.

It is also important to design assessments in such a way that students can only pass them when deep learning has taken place. This requires very specific expertise and it is important to invest in this. Formative and summative assessments should all be aligned and focused on deep learning.

5.6.2 Insight into Students' Needs

In the design phase of an online course, and during the course, it is helpful for the teacher to get insight into the ability of students to meet each other's learning needs. A teacher can easily get this insight by collecting student information in advance. Specific questions to all students or a questionnaire or entrance assessment can be used for this purpose.

Another teaching method, which is particularly suitable to reach deep learning in online education, is the use of peer feedback (Anderson and Rourke 2002; Boud et al. 1999; Moon 2013). The reason for this is that students question the feedback provided by peers. This probes them to think longer and deeper about the feedback, which leads to deep learning (Filius et al. 2018c). This tendency for students to stop thinking when a teacher provides feedback also appears when peers reference to theoretical sources in their feedback. The student accepts it as 'true' and switches to surface learning (Filius et al. 2018c).

Teachers can also monitor progress using a dashboard, as this is one of the advantages of online learning. For example, they can use a graph to quickly identify struggling students or to spot specific topics that need more attention. The design of such a dashboard requires specific expertise, but it is worth the investment for the teachers involved. Moreover, it is not only teachers who can benefit from seeing learning data in real time, but students should also be able to see their own progress along the learning curve as well.

5.6.3 Dialogue Creation

Interaction and, more specifically, creating dialogue are important for achieving deep learning. Previous research indicates how peer feedback mainly leads to deep learning when it takes place in the form of a dialogue, that is, when the recipient responds to the feedback provided. This creates the dialogue between the students, leading them to critical thinking and deep learning (Geitz et al. 2015; Steen-Utheim and Wittek 2017). Learning through dialogue gives students a broader understanding of contrasting ideas which in turn helps to deepen their understanding. For inexperienced online teachers, creating an online dialogue can be a challenge. Dialogic peer feedback to achieve deep learning can be used in both written and spoken (audio or video recorded) form in online asynchronous education. It is worth mentioning that it is not just receiving feedback that leads to deep learning. Providing feedback to peers requires students to integrate all aspects of deep learning, making this an extremely useful teaching method, especially in online education.

A condition for this is that the students are properly taught how to provide peer feedback aimed at deep learning, and more specifically how to record, publish and listen to audio or video recorded peer feedback. The teacher should explicitly embed this into the online curriculum, especially for students less experienced with SPOCs.

Other strategies to create dialogue with students can be the following: asking open-ended questions in order to express their ideas without a specific correct or incorrect answer; and to ask students to suggest questions for a test themselves. Students can refine their ideas in dialogue with others, engage with the content through open-ended questions and re-state observations or remarks.

Our advice for teachers is to start experimenting with assignments in which students have a lot of freedom to use their own interpretation and while experimenting, we encourage teachers to engage in a dialogue with the students about their strategy and their interpretation of these more flexible work forms.

5.6.4 Social Cohesion

Creating social cohesion is important in order to achieve deep learning. Similar to creating dialogue, creating social cohesion in an online class can be challenging for inexperienced online teachers.

One of the strategies to help create social cohesion in an online class is asking students at the start of the course to upload a short video in which they introduce themselves and tell their classmates something about themselves. This usually leads to conversations and personal bonding between the students. Another easy-to-apply method is to call students by their name during the instruction. This is extremely effective, especially when teachers and students do not meet in person and the instruction is asynchronous. As already mentioned, previous research has shown the importance of students feeling personally committed to their learning. Peer feedback, and specifically audio recorded peer feedback, can fulfil that need. Both providing and receiving audio-recorded feedback triggers a feeling of personal commitment, one of the mechanisms in achieving deep learning (Filius, De Kleijn, Uijl, Prins, Van Rijen and Grobbee 2019).

5.7 Discussion

SPOCs have a lot of potential for online higher education, but need a different course design and different pedagogies than face-to-face education. In this chapter, we showed how to exploit and expand lessons learned in MOOCs on scalability and lessons learned in SPOCs on social cohesion.

It remains a challenge to find the right balance between providing scalability on the one hand, and on the other, providing the dialogue that deep learning requires. After all, dialogue demands fixed time slots, while flexibility in times is often the reason why students choose an online medium. However, this chapter may give teachers more insight into the urgency of that challenge and how to meet it.

Online education demands a fundamental shift in terms of the tasks required of the teacher and with more emphasis on the design of courses making sure beforehand that the students are facilitated to get the best out of their education. Therefore, higher education institutions should organise facilitation and training for teachers engaged in blended and online education courses. With the emphasis on design, we also see how the teacher role is shifting. In face-to-face education, the teacher is the content owner, the coordinator and the designer of almost every aspect of the course. In online education, specific expertise is necessary in the design of the platform (virtual learning environment) and the design of the specific teaching methods, in alignment with the learning outcomes of the course. The facilitation of these aspects can be provided by the higher education institutions. Otherwise, it needs to be acquired by hiring external expertise.

In order to allow for scalable education, the teacher should be assisted. The role of teaching assistants and e-moderators has been briefly discussed. For example, they can assume the logistical and technical tasks of the teacher. The e-moderator can also invest in the social cohesion of SPOC classes, by asking questions to promote deep learning and by making sure that individual participants play an active role.

In the future, we need to monitor the development of an artificial intelligence assistant. The developments are moving quickly in this field and artificial intelligence is already being used to answer simple questions posed by students. It may not be that long until we can use artificial intelligence to promoting deep learning in online higher education, further enabling the scalability of this type of learning. In conclusion, when opting for online education, we advocate a new design of education that is appropriate to the online medium. This is a specialism, about which, fortunately, more and more expertise is becoming available and which may contribute to the improvement of the quality of our higher education.

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Chapter 6
Mobile Devices and Mobile Learning in Greek Secondary Education: Policy, Empirical Findings and Implications

Kleopatra Nikolopoulou

6.1 Introduction

Innovations in mobile devices and smart phones allow students to have mobile access to email, videos, internet information resources, course documents, and collaboration on projects. Researchers have called the learning mode that employs mobile technology/devices to facilitate or support learning, mobile learning (m-learning). Mobile learning has been defined as the process of learning mediated by handheld devices such as smart phones and tablet computers (Schuler et al. 2012), or as the learning context in which learners, for example, access a mobile network to conduct their learning, anytime and anywhere, whether in or out of the classroom (Song 2014). For the purpose of this chapter, mobile learning can be defined as facilitating and enhancing the learning process via mobile devices anytime and anywhere, while the use of mobile devices in education (known as m-learning) is considered in terms of its potential pedagogical benefits such as enhancement of student motivation, achievement and communication (Baydas and Yilmaz 2018).

Evidence reports on the high penetration rate of mobile devices and their widespread popularity among the school-age population, particularly in the teenage years (Chee et al. 2017). The rapid development of mobile technology and secondary school students' increased ownership of mobile devices with internet access have the potential to expand communication methods, collaborative learning (Fu and Hwang 2018; Heflin et al. 2017), access to traditional learning and access to information resources (Donaldson 2011). Recent reviews regarding mobile learning research reported on the promotion of students' learning performances and motivation (Chang and Hwang 2019; Crompton et al. 2017), as well as on students' learning/perceptions of specific subjects such as language (Hwang and Fu 2018;

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Kukulska-Hulme and Viberg 2018), science (Bano et al. 2018; Bellou et al. 2018) and mathematics (Bano et al. 2018). The use of mobile devices among secondary school students is increasingly more common (Christensen and Knezek 2018), while mobile learning and mobile technology acceptance research in secondary education is still limited (Hwang et al. 2018).

The topic of mobile learning is not covered in the literature in the Greek context. This chapter aims to present the situation in Greek secondary education, with regard to mobile devices and mobile learning, discussing the existing policy and recent empirical findings. The structure of this chapter is as follows. Initially, it presents the context in Greek secondary education, policy and empirical findings regarding mobile devices' usage and mobile learning. It then presents a recent case study which investigates teacher and student perceptions on educational activities using mobile devices. The last sections of this chapter provide a discussion on the issues raised, consider the implications for further research and summarize the conclusions.

6.2 The Context in Greek Secondary Education: Policy and Empirical Findings

6.2.1 The Policy Regarding Mobile Devices in Secondary Schools

Regarding the Greek context, the ITU report (2018) ranked Greece among a higher scoring European nation in the Information and Communication Technologies Development Index (IDI); between 2014 and 2016, fixed-broadband mobile penetration increased by 4 percentage points in Greece. However, within the Greek formal educational context of secondary education, the topic of mobile learning/devices is not covered in the literature. The integration of mobile phones in Greek (primary and) secondary schools is negatively affected by the current legislative framework. Greece has a centrally supported school system, where for each subject the same official programme of studies is applied. The official curriculum of different subjects for secondary education makes reference to information and communication technologies (ICT), stating, for example, that the subject's objectives can be facilitated/supported by the use of ICT; the new tools (educational software, internet, visualization tools, etc.) multiply the possibilities for students to collect, analyse, visualize, and model data in order for the students to be active participants in the learning process and understand basic principles in science. However, there is no reference to mobile technology/devices or mobile learning. It is noted that all secondary schools in Greece are equipped with a computer lab with internet access (there are no computers in the classrooms). Some schools are also equipped with interactive whiteboards and overhead projectors in some classrooms. As a consequence, those teachers who wish to use ICT in their lessons can either book the computer lab (which is not necessarily available) or they can bring their own laptop in the classroom. Regarding the level of support for teachers in ICT, the information technology teacher who is responsible for the computer laboratory (there is no technician) can offer some support and, in each region, there are technical support centres that cover a number of schools. There are state bodies that support ICT integration in schools and, in parallel, provide in-service teacher training in ICT, for example, the current large program "In-service training of teachers in the utilization and application of digital technologies in the teaching practice" (https://e-pimorfosi.cti.gr/en/), which is co-financed by the European Union and the Greek State.

The official legislative framework (June 2018), from the Ministry of Education states that within the school environment, students may not own mobile phones or any other electronic device/game that has a system of processing image and sound; the equivalent equipment available at school is used during the teaching and learning process only under the teacher's supervision; teachers, apart from the available school-owned electronic devices (computers, laptops, tablets, interactive boards, etc.), can also use their own personal electronic equipment during the lesson, in the context of the educational process in general, in accordance with the safety rules (protection of personal data of pupils and teachers). Many schools have Wi-Fi (there are not official data), and it is up to the head-teacher of the school unit to decide who will have access; the codes are usually given only to teachers, while for safety reasons, the Wi-Fi may be inoperative for certain periods of time.

Within this context, a few teachers take initiatives and allow their students to use mobile devices/phones in classroom, for educational purposes (since the official curriculum makes no reference to mobile learning). They take this decision, because they believe that their lesson(s) can be enhanced and supported and/or they participate in a research project (in the latter case, permission from parents and consent forms are required); as mobile devices are "banned", the teachers take the responsibility for their actions.

6.2.2 Empirical Findings

Although mobile phone use is officially banned, during the school breaks (despite the ban), several students "switch on" their mobile phones in order to take photos/videos, send messages or enter social networking sites (Nikolopoulou and Gialamas 2017), while within semi-formal settings pre-determined by a teacher (such as school projects, museums and field trips), students are allowed/encouraged to use their mobile devices. Significant causes of restricting mobile phone use in schools are the protection of privacy (e.g. pupils taking photos of their peers/teachers in the classroom) and the possibility of sending messages that can lead to cheating. The official ban is a major reason that very few teachers use mobile devices in formal educational contexts.

In parallel, there are very few studies regarding teachers' or students' attitudes. Investigating teachers' and students' perceptions towards mobile devices' usage and mobile learning is an important first step for the implementation of mobile learning in formal educational contexts. Kousloglou and Syrpi (2018) investigated Greek secondary school teachers' perceptions on the use of mobile phones for educational purposes; around 38% of the sample said that they often use mobile phones/tablets for educational use, while 75% of respondents expressed willingness to integrate mobile devices in the learning process (they said, it is likely to increase students' interest/motivation), if the law allows it. When teachers allow their students to use mobile phones, this happens under supervision (e.g. in clubs, during school projects, physics experiments or extra-curricular activities). Regarding Greek secondary school students, studies indicated positive attitudes and high self-efficacy towards mobile devices' usage (Nikolopoulou and Gialamas 2017) and little self-perceived mobile phone dependence (Nikolopoulou and Gialamas 2018). Another study (Nikolopoulou 2018) revealed secondary school students' positive perceptions towards mobile learning acceptance and high mobile device usage in informal settings; the mobile phone was the predominant device which is used daily by almost all students, 83% of the sample goes online via a mobile device several times per day, and 65% described themselves as advanced mobile device users. It is noted that the above studies were carried out for academic usage. Nikou and Economides (2018a, b) indicated that in mobile-assisted inquiry-based science learning, perceived autonomy was the strongest predictor of engagement. They proposed a series of mobile-based micro-learning and assessment activities for secondary school students of science, and indicated improvement of student learning performance and enhancement of motivation. Table 6.1 summarizes recent empirical findings from studies undertaken within the Greek secondary education.

6.3 Teachers' and Students' Perceptions on Educational Activities with Mobile Devices: A Case Study

6.3.1 Research Objectives

The objectives of the case study were as follows:

- What educational activities are carried out in classrooms, by using mobile devices?
- What are the teachers' views on the advantages and disadvantages of using mobile devices in the classroom?
- What are the students' views on the educational activities they would like to do with mobile phones in the classroom (in different subjects), the problems that may arise and the rules that should apply (so as to avoid problematic mobile phone use in the classroom)?

This case study was carried out as part of the research project "Mobile technology supported learning in Greek educational settings" (the project was initiated by

Table 6.1 Empirical findings from Greece

Studies	Major findings
Nikolopoulou and Gialamas (2017)	12- to 15-year old pupils reported positive attitudes and high self-efficacy in using mobile devices. Higher self-efficacy was linked to positive perspectives and feelings, to greater willingness to use mobile devices, and to favourable perceptions towards their independent control
Nikolopoulou and Gialamas (2018)	Little self-perceived mobile phone dependence seems to exist among adolescents (aged 12–18 years). Girls reported higher dependence in comparison to boys, while grade (or age) had no effect
Nikolopoulou (2018)	Mobile phone was the predominant device which is used daily by almost all students (aged 12–18 years). 83% of the sample goes online via a mobile device several times per day, while 65% described themselves as advanced mobile device users
Nikolopoulou (2019)	The majority of pupils aged 13–15 years believe that mobile devices are an incentive for learning, mainly because these help in searching for information, they are interesting, and they help pupils in completing the school assignments. The school subjects for which many pupils would be more interested, in case mobile devices were used in the classroom, were physics, mathematics and history
Nikou and Economides (2018a, b)	In mobile-assisted inquiry-based science learning, perceived autonomy was the strongest predictor of engagement. A series of mobile-based micro-learning and assessment activities were proposed for secondary school students of science; an improvement of student learning performance and enhancement of motivation were shown
Kousloglou and Syrpi (2018)	Secondary school teachers' perceptions on the use of mobile phones for educational purposes were as follows: Around 38% of the sample said that they often use mobile phones/tablets for educational use, while 75% expressed willingness to integrate mobile devices in the learning process (they said, it is likely to increase students' interest/motivation) if the law allows it
Nikolopoulou and Kousloglou (2019)	Mobile technology-supported learning activities were implemented in physics lessons; students aged 12–15 years showed enthusiasm, participated actively in the experiments and collaborated in groups.

the author of this chapter). The case study was carried out in a state experimental school in Athens; the policy of experimental schools in Greece encourages teachers to undertake research initiatives, to try/implement new teaching methods/materials and to disseminate the findings. It is noted that the researcher-author had worked as a science teacher for some years in this school and was familiar with its environment.

6.3.2 Sample, Questions and Procedure

The participants were 23 teachers and 77 students. Table 6.2 shows the characteristics of the sample. The data from the teachers were collected in June 2018 (since during that period, teachers have better time availability and evaluate the activities

Table 6.2 Demographic characteristics of the sample (teachers and students)

Teachers ($n = 23$)	Students ($n = 77$)
Gender Female: 14 Male: 9	*Gender* Female: 34 Male: 43
Specialization Greek language-literature: 6 Science: 4, information technology: 3 Foreign languages: 3, mathematics: 3 Home economics: 1, arts: 1, religion: 2	*Age group* 13–14 years old (or year 8): 48 14–15 years old (or year 9): 29
Years of teaching experience 6–10: 2 11–15: 4 16–20: 8 20^{+}: 9	
Ownership of a mobile device with internet access	
Yes: 22 No: 1	Yes: 76 No: 1
Years of using a mobile device with internet access	
More than 5 years: 18 3–5 years: 2 1–2 years: 2	More than 5 years: 24 3–5 years: 42 1–2 years: 10
Frequency of going online via *a mobile device*	
Several times per day: 18 Around once per day: 2 2–4 times per week: 2	Several times per day: 64 Around once per day: 10 2–4 times per week: 2
Mobile devices' usage in class yes: 20 *Frequency of m-device use in class* (out of 20) Daily: 1 Weekly (2–4 times per week): 7 Monthly (2–4 times per month): 9 Less than once per month: 3	

of the academic year for the annual report) and from the students in January 2019. Teachers were asked to complete a questionnaire including short open-ended questions regarding the educational activities carried out in classrooms with mobile devices, as well as their views on the advantages and disadvantages of using mobile devices in the classroom. Students were asked on the educational activities they would like/wish to do with their mobile phones in the classroom (in different subjects), the problems that may arise and the rules that should apply (in order to avoid problematic mobile phone use in the classroom). All questionnaires were anonymous; the participants were informed for the research purposes, while the students were assured that their responses would not be linked to their assessment.

6.3.3 Results

Regarding the first objective, Table 6.3 shows the educational activities carried out in classrooms, by using mobile devices (mostly laptops), as these were reported by the teachers: the presentation of audio-visual material (video, images, documentaries, etc.), presentations of students' work, presentation of educational material (interactive exercises, simulations, experiments, lesson notes, etc.), finding bibliography, etc. Some extracts from the questionnaires were: "*with a mobile phone, performing mathematical calculations*" (mathematics teacher), "*watching video, student presentations and experiments, exercises*" (physics teacher), "*presentation of a lesson via the laptop, video watching, interactive exercises, e-Twinning program, e-class*" (home economics teacher). The type of the mobile device used in class was mainly the laptop (of the teacher/school), followed by the (students') mobile phones, while the type of the device was linked to the way of its use. For example, when there was only one laptop in the classroom it was used for the presentation/demonstration of video/simulation/images or for the presentation of students' work. Instead, mobile phones were used by students (in particular when they worked in groups) in order, for example, to make mathematical calculations in mathematics/physics, to measure with accuracy the time of an oscillation in physics experiments in the lab, or to take pictures/videos of an activity.

Regarding the second objective, Table 6.4 shows teachers' views on the pros and cons of mobile devices' usage in class. Regarding the pros, most references (14) indicated quick access to information, the internet and easier search for information, while afterwards, teachers reported that the lessons become more attractive and stimulate students' interest. Indicative excerpts from the questionnaires were: "*Attractive lesson, students pay more attention to the lesson*" (religious teacher), "*Visualized learning is favored. Students with learning disabilities are better supported*" (literature teacher), "*development of cooperation among students, easy access to information*" (French teacher), "*direct access to information, comparison of many different sources, promotion of interaction, communication*" (arts teacher). Regarding the disadvantages, most references concerned students' distraction, noise and chaos in the classroom, as well as limited use of handwritten notes (8, 7 and 7

Table 6.3 Educational activities carried out in classrooms, by using mobile devices

Activities with students	References
Presentation of audiovisual material (video, images, documentaries, etc.)	18
Student presentations (students presenting their work in PowerPoint)	14
Presentation of educational material (interactive exercises, simulations, experiments, lesson notes, etc.)	12
For projects	10
Finding bibliography	8
Group work	4
Search for information on the internet	4
Other (e-books, e-class, problem-solving)	3

Table 6.4 Teachers' views on the pros and cons of mobile devices' use in class

Pros	References
Quick access to information, internet, easier search of information	14
Attractive lesson, it (mobile device) provides stimuli for learning	9
Participation/engagement of all students, students pay more attention	5
Interactivity	3
Collaborative learning	3
Development of technological literacy	2
Children with learning difficulties are favoured	1
Exchange of educational material between students and teachers	1
Self-motivated students	1
Visualized learning	1
Cons	
Distraction	8
Noise in class, chaos in the classroom	7
Limited use of handwritten notes, or writing	7
Students during the lesson enter other websites, social networks	3
Technical problems, Wi-Fi connection	2
Lack of appropriate software	1
Dependence on the internet, on mobile phones	1
Electromagnetic radiation	1
Concerns on privacy	1
Restrictions of ready images	1

references, respectively). Indicative excerpts from the questionnaires were: "*Dependence on the internet and the mobile phones, excessive time online via mobile phones*" (literature teacher), "*Distraction, limited use of writing*", "*Lack of appropriate educational software, technical problems concerning sound or lighting, etc*." (home economics teacher).

Regarding the third objective, Table 6.5 illustrates students' views on educational activities they wish to carry out in different subjects, with specific tools/applications of their mobile phones (the number of references in brackets). A table with three columns and the basic school subjects was given to students; at the bottom, a few lines were left empty for the students to write another subject(s) of their choice. Some subjects were grouped such as sciences (physics, chemistry, biology and geography), foreign languages (English, French and German) and literature (modern Greek language, ancient Greek language, literature).

It is mentioned that some students faced difficulties in completing the table, since they wrote mobile applications under the educational activities column. Some excerpts from students' responses are presented below: "*Video: to get a video of an*

Table 6.5 Students' views on mobile phone tools/apps and school activities in different subjects

Mobile phone tools / applications	Educational activities	School subjects
Stopwatch (65) Internet (64) Values convertor (23) Videos (20)	Time measurement Information Unit conversions Experiments	Sciences
Calculator (77) Internet (30) Notebook (20)	Operations (quickly, accurately) E-class (see lessons) Take notes	Mathematics
Internet (55), Search engine (41) Calculator (20) Videos (9) MS Office (10) Camera/Notebook (8)	Search for information (programs/apps), E-class For additions/subtractions To see or understand a program To use/create files Course/lesson notes	Information technology
Internet/Google(68) Dictionary/Wikipedia (55) Camera/Video (12) E-class (2)	Information for assignments, translations Find words, spelling, word meaning, grammar Course notes Additional exercises	Literature
Search Engine/Google(56) Videos (55) Wikipedia (9) Camera (5)	Finding sources, historical events, diagrams View events that are not in books Terminology Take photo of the lesson from the school board	History
Google translator (75) Dictionary (73) Videos (10) E-mail (5)	Translation, spelling, pronunciation of words For unknown words Listen to texts Communication	Foreign languages
Search Engine / Google (63) Drawing (6) Camera (4)	Search for artists, pictures, paintings To draw Take a picture of something	Arts
Stopwatch (7)	Time (or speed) measurement	Sports

experiment", "*Stopwatch: to measure the time in experiments*" (sciences), "*Calculator: for operations with negative, decimals or variables that do not exist in pocket calculators*" (mathematics), "*Camera: so that what is shown on the blackboard is stored on my mobile phone*" (Information Technology), "*Dictionary: to find what does a word mean, its etymology*" (Greek language), "*Internet: to find texts that are not in the book or information about an author*" (literature), "*Video: for historic events, people in history*" (history), and "*Photos/internet: to see something on the internet and then paint/draw it*" (arts). Students' views with regard to the problems that may arise from mobile phone use in the classroom were mainly linked to student distraction (30 references). Other problems included chat or sending email (11 references), playing games (10 references), taking photos/videos of classmates/teachers (9 references), and cheat in tests/exams (5 references). Some excerpts from students' responses were: "*Some students may when the teacher tells kids to do an exercise or get information about something, instead of doing what the teacher has said to them, they can play or use another application*", and "*they can take photos of other students without their will, play in the classroom and not attend (the lesson), or they could cheat on tests/exams*". Students' views on the rules that should apply so as to avoid problematic use of mobile phones in the classroom were: the existence of teacher supervision/guidance (14 references), punishment (14 references), mobiles should be switched-off/silent (12 references), use of internet only for educational purposes (9 references), not to allow video capture or social networks. Some excerpts from students' responses were: "*In my view, mobile phones should remain switched-off during the lesson, unless the teacher wants (these to be used) for some reason e.g., activity in the classroom*", and "*Internet access should be banned if its use is not necessary. If necessary, it should be supervised by the teacher*".

6.4 Discussion and Implications

The results of the case study revealed that the activities carried out in classrooms with mobile devices regarded, mainly, the presentation of audiovisual material (videos, pictures, documentaries, etc.), presentations of students' work and the presentation of educational material (interactive exercises, simulations, experiments and lesson notes). Teachers' views on the pros of mobile devices' usage included quick/easy access to information, attractiveness of the lesson and interactivity; regarding the cons, they reported distraction of students' attention, classroom noise and limited use of handwritten notes. There is some agreement with earlier research in Greece (Kousloglou and Syrpi 2018) and internationally (Taleb et al. 2015), with regard to the teachers' perceptions on mobile devices' benefits (in particular, their power to mobilize pupils' interest), and disadvantages (e.g. distraction in the classroom) (Lenhart et al. 2010). Students aged 13–15 years reported a variety of mobile phone tools/applications they would like to use in class, for different activities, in different subjects. They mainly mentioned the use of the internet/Google in almost all subjects (for information search), the calculator in mathematics, the dictionary/Wikipedia in Greek language, literature and foreign languages (for finding words, terminology, articles) and the Google translate in foreign languages (for translation, spelling and pronunciation). Some of the educational activities reported by the students are similar to the activities already carried out in classrooms using mobile devices (mainly laptop); for example, the use of the internet for searching for information. As a consequence, students' views were influenced by the activities they had experienced in school subjects. There is partial agreement with earlier research in other countries, as the majority of students would like to have access to the internet/search engines (Bartholomew and Reeve 2018; Mauricio 2017) and to e-dictionary applications (Mauricio 2017). In the case study, almost half of the sample of students reported the problem of mobile phones distracting students' attention, while 1/5 of the sample mentioned rules to avoid problematic phone use (supervision/guidance by teachers). The results of the case study and of the empirical findings from Greece have all implications for the students, the teachers and the education policy-makers.

The use of mobile devices in classes is an incentive for learning for many students (Chang and Hwang 2019). However, there are serious risks (personal data security, distraction) which many students seem to ignore. Thus, there is a need to inform and guide students about the safe and appropriate use of the mobile devices (in particular, of mobile phones) for educational purposes. Regarding mobile phones, their use in classrooms is suggested under certain conditions, for specific activities that cannot be achieved by other traditional/technological means. An obstacle that is overtaken by the use of students' mobile phones in classrooms is the student–device ratio: their use can occur in the classes when an educational need arises (even for 10 minutes) without the need to bring students to the computer lab. Apart from students, it is necessary to educate teachers in classroom management and student guidance (compliance with rules, avoidance of problematic use, etc.). Although there is some ground for the use of mobile devices in classes, this is mainly dependent on the teachers who will design and implement appropriate learning activities for their students. The role of the teachers and their openness to explore mobile technology are crucial. Pedagogical ICT training could include a sub-unit regarding digital mobile devices (including mobile phones). Educational policy-makers may incorporate basic guidelines for mobile devices usage into the official programme of studies; effective educational policies are needed. Curriculum planners should recommend the use of mobile devices as a complementary resource/tool to support educational activities that are difficult or impossible to be carried out with other means. In parallel, appropriate rules and regulations should be put into place to guide the use of mobile devices/phones in the classroom.

6.5 Conclusions

This chapter provided insights into the context of Greek secondary education with regard to mobile devices and mobile learning, discussing the existing policy, recent empirical findings and implications. The integration of mobile devices in Greek secondary schools is negatively affected by the current legislative framework. However, despite the ban, a few teachers take initiatives and allow their students to use mobile devices/phones in classrooms for educational purposes. Empirical findings revealed that teachers reported positive perceptions towards mobile learning, being aware of the pros and cons of mobile devices' usage in classrooms. Students reported positive perceptions and high self-efficacy in using mobile devices, they could name educational activities they would like to do with their mobile phones in the classroom, but fewer students could name specific problems associated with the use of mobile phones. It is therefore essential that students will be informed about the dangers and also the potential benefits of using mobile phones in the classroom. In parallel, educational policies need to address issues such as ownership of mobile devices, tools to support the curriculum, appropriate behaviour in school and privacy-security of data (photographs, video etc.) in order to avoid distraction in class, cheating and inappropriate recording of students/teachers. Help desks, instructional assistance and support services are suggested as methods to facilitate the integration of mobile technology in the classrooms. The use of mobile devices is not a guarantee of learning, so educational planning needs to be pedagogically documented. The focus of the use of mobile devices in education is learning, the principles that govern it and the conditions for their effective use; secondary school curricula and teaching approaches can no longer ignore that mobile devices/phones are part of students' everyday life. Teachers' professional development in mobile technology integration-usage is essential; teachers' support and in-service training will equip teachers with the necessary skills, confidence and knowledge to integrate, when appropriate, mobile technology in the classroom. It is suggested to investigate small-scale practices of teachers who try out appropriate uses of mobile devices in different subjects, for example, to identify teachers who are willing to use mobile phones as complementary tools to more traditional teaching.

Mobile learning in secondary education contexts is still in its infancy in Greece. The fact that the mobile phone (with its new advanced features, attributes and functions) is the predominant mobile device for teenagers (Nikolopoulou 2018) provides a challenge for the implementation of mobile learning in secondary educational contexts. New mobile technologies could affect learners' perceptions and behaviours in the learning environment. The research project "Mobile technology supported learning in Greek educational settings" is in progress; future papers are planned with a larger sample of Greek primary and secondary school teachers in order to investigate teachers' readiness – acceptance towards mobile learning, as well as the factors influencing teachers' perceptions. Future research is suggested to investigate the various learning activities practised in secondary school classrooms (in different subjects) with different types of mobile devices, as well as the institutional support to integrate such activities.

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Chapter 7
An Exploration of Chinese Students' Self-Directed Mobile Learning Outside School: Practices and Motivation

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7.1 Introduction

Most contemporary adolescents have been exposed to digital technology since their birth (International Reading Association 2012) with resulting changes in their literacy practices (Lankshear and Knobel 2012; Ito et al. 2009). They are also experiencing transformations of teaching and learning (Ng 2010) in school and outside school. In China, as in western countries, technology has begun to be integrated into education in an attempt to 'introduce a "new direction" into the Chinese education system' (He and Wray 2016). The integral role of technology in education was clearly seen in the 'Education and Information Technology Ten-Year Development Plan' (2011–2020) (MoE 2012) which was followed by a series of efforts including investment in the ICT industry, in school facilities and in teacher training (He 2005; MoE 2010). Apart from the efforts of central government, the mobile learning market has also been growing (Adkins 2015) because of the increasing ownership of mobile devices and the desire for learning anywhere and anytime without restriction (Fok 2012; Henderson and Chapman 2012). It has been revealed by the latest 'Statistical Survey on the Internet Development in China' (CNNIC 2016) that mobile phones have become the most important and frequently used devices for internet access, with 90.1% penetration reported for 2015.

Mobile phone ownership in China has been increasing dramatically, especially among those of school age, which has drawn the attention of scholars as they try to understand the usefulness and efficiency of mobile learning and the ways in which users interact with their mobile devices (Hwang et al. 2011; Ko et al. 2015; Liu et al.

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2010; Rau et al. 2008; Wang et al. 2009a). Many studies have investigated students' experiences of using mobile devices for learning under the guidance of teachers (e.g. Hwang et al. 2011) and have tried to develop an understanding of the impact of mobile learning on behaviour and performance (Wang et al. 2009b). With such powerful accessibility features (Sharples et al. 2005), many researchers have looked at impacts such as engagement and the outcomes derived from mobile learning beyond the classroom as traditional instruction has been extended to encompass real-world learning (Boyce et al. 2014; Lin and Chen 2015; Zhang et al. 2011). Motivation has been explored through studying students' practices in mobile learning (Rau et al. 2008) and the impact of these upon learning and the bonds between learners and teachers. Both extrinsic and intrinsic motivations have been identified when students are engaged in mobile learning activities (Sha et al. 2012). In addition to being offered instruction through the physical presence of teachers, students seem to be using mobile devices outside the classroom without instruction from teachers or parents. There has been less research into students' motivation and autonomy in such mobile learning activities especially when teachers have no presence during learning activities. More studies are needed in order to understand the mobile learning practices of students as self-directed learners and what they think about mobile learning without direct instruction within different social and cultural contexts.

7.2 Literature Review

7.2.1 Mobile Learning: A Brief Overview

Mobile learning can be simply defined as learning through the mobile technologies widely used in daily life (Quinn 2000). One of the most significant features of mobile learning is widely considered to be its ubiquity, that is that the technology follows the learners who 'are continually on the move' (Sharples et al. 2005, p.97). Learners are able to gain knowledge without restrictions of time, space and accessibility (Chen and Huang 2012; Evans 2008; Peng et al. 2009; Sha et al. 2012).

Given the educational application of mobile technologies and the popularity of mobile devices among students, many researchers and educators have been trying to explore the uses and benefits of mobile learning in classrooms from schools to universities (Evans 2008; Herro et al. 2013; Makoe; 2010; Wang et al. 2009a; Yang et al. 2015). Mobile devices such as mobile phones and tablets have been considered to have the potential to encourage active learning, collaboration, interactivity and interaction in the classroom (Markett et al. 2006; Lindquist et al. 2007; Yang et al. 2015). Many studies have shown positive impacts from the use of mobile devices to enable learning. Evans (2008), for example, used podcasts as a portable way to support undergraduate students' revision. Students were able to access these materials easily based on their personal learning plans and needs. It was found that students tended to be receptive to podcasts as a way of learning and seemed to be more efficient in learning than when they used printed textbooks. Students in the mobile learning environment also have the tendency to collaborate with peers (Reychav and Wu 2015; Reychav et al. 2015). In a relatively recent study, Reychav et al. (2015) found that collaborative learning was emerging through interactions among students using social networks. Similar advantages have been identified in school education. Some schools provide students with tablets or other mobile devices with apps or games to promote student engagement and motivation (Su and Cheng 2015; Zhang et al. 2015). In a case study of two digitised classes in China (He and Wray 2016), students used tablets to answer quizzes, search for information and have online group discussions. Interactions between students and teachers helped to promote student-centred learning in these classrooms.

The usefulness of mobile learning in terms of engagement, effectiveness, and collaboration has also been examined in the context of second language learning (Lu et al. 2014; Wu et al. 2012). Learners have been found to be more engaged in practising language through the use of mobile devices than through traditional classroom learning activities. In a study of the use of an application for Chinese characters learning (Lu et al. 2014), both teachers and students found that using this application could be enjoyable and effective in promoting useful learning outcomes.

In settings beyond the classroom, mobile devices have been largely used as extension tools to help link the real world to classroom learning in many subjects including computer studies, mathematics and science (Chen and Huang 2012; Medzini et al. 2015; Wu et al. 2012). Many studies have focused on the use of a mobile learning system with various mobile devices outside the classroom to situate students in a real-world learning scenario (i.e. museums, field trips, plant gardens, zoos) (e.g. Boyce et al. 2014; Paredes et al. 2005). Students in outdoor learning activities have been guided by mobile devices to observe targeted objects with their responses being recorded so that teachers could build on this learning later in the classroom (Chen and Huang 2012; Chu et al. 2010). Based on these approaches, students were expected to gain knowledge from both real-world and digital-world learning resources, using pre-installed mobile learning systems in mobile devices rather than by sitting in the classroom and reading from textbooks. Chu et al. (2010) discussed a two-tier test approach through which a teacher could give guidance to students via mobile devices. In this study, students were offered mobile phones equipped with the two-tier test guiding system and were asked to observe and classify different plants in the school's garden. Basic tasks were set to all students in the beginning. Follow-up tasks were then set to individuals based on their performance on those basic tasks. Positive impacts were identified which suggested that students had benefitted more from learning in the real world with mobile devices than they would have from learning in the conventional classroom.

Studies such as these strongly suggest that guidance and instructions for specific mobile learning systems are important for learners, especially when they are not in traditional learning environments, to make sure that students get involved in mobile learning activities. Students' motivation, creativity and ability to learn and absorb knowledge seem to increase under proper guidance and instruction (Chen and Huang 2012). However, many mobile learning activities are carried out without supervision or instructions from teachers or parents. This begs several questions. For example, what motivates students or learners to engage with mobile learning outside the classroom, in informal settings, and to act as self-regulated learners? How do students manage mobile learning activities and how do they deal with task, time and results?

Some researchers have explored the acceptance of mobile learning based on technological characteristics, compatibility and other factors (Cheng 2015; Liaw et al. 2010; Liu et al. 2010) including perceived usefulness, ease of use, personal innovativeness and learning enjoyment. Others, however, have argued that mobile learning concerns more than just the dimensions of technology and institution (Baker et al. 2014). It is how learners experience, explore and create within the mobile learning system that makes them successful (Sha et al. 2012; Sharples et al. 2005, 2007). Students' understanding of their roles as self-regulated learners in mobile learning appears to be a crucial factor (Sha et al. 2012).

There remain, however, many issues that require greater understanding. How, for example, do learners engage with mobile devices in different social and cultural contexts? As mobile learning has become more personalised and user-centred (Motiwalla 2007), some studies have focused on the motivation, autonomy, skills and knowledge that learners gain through everyday mobile learning activities (Ciampa 2014; Waycott et al. 2005). More research is needed to examine the factors that underpin self-regulated mobile learning without instruction or guidance.

7.2.2 Motivation and Mobile Learning

There is no doubt that motivation is an important factor affecting learning behaviour and outcomes (Chen and Jang 2010; Lim 2004; Rau et al. 2008). Motivation is defined as 'the process whereby goal-directed activity is instigated and sustained' (Pintrich and Schunk 2002, p. 5). Learners who are directed by goals have the 'tendency to find academic activities meaningful and worthwhile and to try to derive the academic benefits from them' (Brophy 1998, p. 205–206). Previous studies have demonstrated several orientations of motivation such as intrinsic and extrinsic (Malone and Lepper 1987; Moneta 2004; Ryan and Deci 2000) that can have significant impacts on engagement and persistence during activities (Vogel et al. 2009). Ryan and Deci (2000) argued that it is the type and quality of motivation which matters more than the level or quantity of motivation. Intrinsic motivation is more desirable (Rau et al. 2008) because it focuses upon activities which are 'inherently interesting or enjoyable' (Ryan and Deci 2000, p.55). Learners who are intrinsically motivated tend to have more persistence, and higher levels of satisfaction when engaging in activities. In contrast, extrinsic motivation emphasises the instrumental value of activities, that is, the external rewards which attract learners. Chinese students have been found to be highly extrinsically motivated in highly competitive environments in order to attain high marks during examinations (Rau et al. 2008). Intrinsic motivation, however, was found to be operating alongside extrinsic motivation when Chinese students were involved in some technology-mediated learning activities (He and Wray 2016). Some researchers (Chen and Jang 2010) suggest that more attention should be paid to motivation in online learning to understand students' affective and socio-emotional processes.

No matter what kind of motivation theory is applied in mobile learning studies, it has clearly emerged that both personal commitment and external factors are important and cannot be separated especially when self-directed learning happens outside the classroom. It is necessary to think what kind of motivation can be derived from self-directed learning outside the classroom and how this environment can hinder or enhance learning outcomes. In mobile learning, the frequently applied SDT model (Deci and Ryan 1985) identifies three main aspects of self-determination: autonomy, relatedness and competency. Autonomy refers to one's responsibility, and agency in one's own affairs (Bao and Lam 2008; Chen and Jang 2010). It seems very important for self-directed learners to have control over their learning activities and digital devices (Schober et al. 2007). Several studies have explored autonomy or self-directedness in mobile learning by applying self-regulated learning as a framework (Sha et al. 2012; Tabuenca et al. 2015). In self-regulated learning, learners are proactive and can organise their own thinking based on the interplay of environmental factors and individuals' characteristics (Bandura 2001). This relates strongly to our attempts in this study to understand how Chinese students, under great examination pressure, cope with the less targeted activities in mobile learning and manage to direct their own learning.

7.3 Research Questions

Previous studies show that students exhibit a diversity of practices in using digital technologies in daily life (Alvermann et al. 2012; Stewart 2014). Little is known, however, about Chinese secondary school students' out-of-school mobile learning activities, against a background in which the school experience of these students is dominated by the examinations they have to pass, with the consequent school focus upon the factual, rote learning that these examinations emphasise. Therefore, the present study was designed to answer the following research questions with regard to secondary school students in China.

- What mobile learning activities did a group of Chinese secondary school students engage with outside of school?
- What was driving these students to use self-directed mobile learning activities?
- How did this group of students deal with mobile learning activities and curriculum-based tasks?
- How did the students perceive that the mobile learning activities had impacted upon them?

7.4 Methodology

The study used qualitative methods to investigate Chinese students' self-directed learning practices with mobile devices outside of school. Focus groups and individual interviews were used to explore the perceptions of students.

Focus groups were used as 'the preliminary or exploratory stage of a study' (Gibbs 1997). Five focus groups were conducted. Each group consisted of four participating students, two girls and two boys, all aged 15–16 years. Students in the groups were encouraged to talk about their beliefs about and attitudes towards using mobile devices for learning without instructions or guidance. Some mobile learning practices were identified for the follow-up in-depth individual interviews to gain a deeper understanding.

Following the focus groups, three students (Ming, Long and Mei), each with a different level of usage of digital devices, were selected for follow-up individual interviews. These interviews aimed to get a deeper understanding of the motivations, strategies and autonomy of these Chinese secondary school students as they engaged in self-directed mobile learning practices. Their perceptions of the usefulness and problems of self-directed mobile learning were also examined. Several semi-structured interview questions were guided by what students claimed in the focus groups in order to find out the reasons underpinning their learning practices outside of school with mobile devices and how they handled curriculum tasks and self-directed learning practices.

Of the three students, Ming, one of the boys, owned his own smartphone and used it very often after class. He said that he knew a variety of software/applications and websites for learning and he regarded himself as a good user and a pioneer in class of mobile learning with his smartphone. Long, the second boy, did not have his own mobile devices but he often borrowed his parents' smartphone or tablet for learning practices. Mei, the girl, had her own iPad and smartphone, and said she would love to use mobile devices for learning purposes but she complained that she got distracted very easily when she used mobile devices for learning on her own.

Thematic analysis was employed in order to identify patterns in these Chinese students' mobile learning practices and what they thought about self-directed mobile learning outside of school without teacher or parental guidance.

7.5 Findings

7.5.1 Types of Self-Directed Mobile Learning Practices

From the focus groups and individual interviews, several learning practices with mobile devices were identified, which can be categorised as two types: curriculum-based mobile learning practices and interest-based practices. The most common practices in curriculum-based work included doing quizzes using education applications, systematic revision for examinations and using learning assistant software to help with schoolwork/homework problems. The students suggested that they used education applications from three to five times a week to enhance their understanding of certain topics especially for mathematics or science subjects. Education applications that the students often used were originally designed for secondary school students for preparation for the GaoKao (National College Entrance Examination). Students had access to quizzes for different subjects and clearly used these regularly.

For interest-based learning practices, students claimed that they often visited online forums where users interacted in different groups based on their interests. Students asked questions related to these interests and answered each other's questions. They also interacted with other members by reading comments and responding. Resources such as articles, video clips and web link were often shared among group members.

7.5.2 Practices and Ownership

Student mobile learning practices were found, to some extent, to differ according to their ownership of mobile devices. Students who did not have personal devices said that they usually borrowed smartphones or tablets from their parents after they had finished the school day. Long had no personal devices and borrowed his mother's smartphone when he came across some hard questions in homework. He said that 'I asked my mom to install the Xueba Jun (type of learning assistant software) on her phone so that I could take pictures of those questions that I cannot solve'. However, he explained that he could only use a mobile phone for no longer than one hour, and so all he could do was to use the software to seek for answers to questions. 'I usually borrow mom's phone three times a week and she sits not far away from me, you know, I cannot do other things on the phone except using that software. There is other software or online forums that I could visit for more than finding answers. But I don't have my own phone, lots of restrictions', Long explained.

Students who had their own mobile devices had much more flexibility in mobile device usage and learning practices with smartphones or tablets. Ming, a self-perceived pioneer user of digital devices for learning, was proud to claim that 'I do different things with my mobile phone for learning. I always tell my friends what software is worth using and what is not that good. I know a lot of software and online forums. They are satisfied with my recommendations'. He claimed that he used learning software or online groups as long as he had time. During class breaks, he liked to share information or websites with friends who had common interests. Mei had different learning practices and said that she spent more time on reading articles or communicating with group members on an online forum than using learning software. She often visited a fan-fiction forum to discuss her ideas of writing and made comments to other users.

7.5.3 Motivation

Both extrinsic and intrinsic motivations were found among these Chinese students in their self-directed mobile learning practices. They claimed that they were in a highly competitive situation where they were pushed to obtain good outcomes in examinations. Ming said that, ‘I used the education software as a systematic approach to review what I learnt so that I can get well prepared for examinations. On the other hand, online education software is an open platform which everyone can access, which means I am not just competing with people around me. I have to compete with people around my age.’ Environmental factors such as competition and pressure acted as stimuli for the students to set extra work for themselves by using mobile learning applications. These, they argued, were a good way to get detailed answers for questions without spending a large amount of time asking help from others. Long explained that he could save some time by using assistance software so that he could spend more time doing more quizzes. Mei found that she managed to get higher marks after she frequently used education applications by doing lots of quizzes. She believed that her grasp of knowledge was deepened through these quizzes.

Apart from being affected and motivated by external factors, these students were intrinsically motivated for self-directed mobile learning practices. They enjoyed using education software in terms of knowing their level and moving to higher levels through practices. Ming claimed that it was a challenge to finish quizzes that he did not come across in homework and he got a sense of fulfilment when he solved hard questions that he did not expect to. They all claimed that it was very interesting to get support and help from group members even though they did not know each other. Mei said she was happy that her ideas were recognised and she could hear different voices and have her voice heard as well.

7.5.4 Autonomy

According to the students, they were able to balance schoolwork or homework and self-directed mobile learning practices. Apart from those who used their parents’ mobile devices within a relatively fixed time, students usually arranged mobile learning practices on a daily basis after they finished their teacher-set homework. They argued that the secret of finding time to do extra practice was absorbing from class as much as they could with total concentration.

Students adopted different practices with various difficulty levels based on their perceived grasp of material. They claimed that they would do quizzes at a similar difficulty level to homework if they felt that they did not grasp the content of this homework. They would also do extra practice through mobile learning at a higher difficulty level if they were happy with their homework performance.

7.5.5 Concerns

The students indicated that they were concerned that they might not be able to think independently if they used mobile learning applications too much for curriculum-based tasks. Long claimed that he could not help thinking of taking a picture of questions set even though these were not too hard for him with a bit of thought.

Another concern was that they might choose quizzes and practices which were far too difficult for them. However, they complained that not all problems could be solved because the analysis provided by the application was not always right. They suggested that they sometimes needed support from teachers or others in addition to the learning software.

7.6 Discussion

The present study has focussed on the self-directed mobile learning practices of a small group of Chinese students and their motivations for and autonomy in such practices when they are under extreme examination pressure. The exploration of students' perceptions has suggested some challenges that might help to understand mobile learning in the Chinese context.

The findings suggest that these Chinese students were using mobile devices for a variety of learning practices outside of school based on personal needs in terms of interests and academic expectation. Chinese secondary school students, like adolescents in other countries, are exposed to the fast-changing development of technology and digital environments (International Reading Association 2012; Ng 2010). They are regarded as the generation who are becoming competent with skills of using digital technologies through daily living and learning practices in and out of school (Eynon and Malmberg 2011). The students in this study suggested that their competencies with digital technology and their notions of learning in a digital environment were shaped by emerging applications and software when they were involved in new mobile learning activities. A new skill set for using mobile devices for learning had been developed through their mobile learning practices. Mobile devices had provided them with opportunities for learning beyond the walls of classroom and the ubiquity of mobile learning (Sharples et al. 2005) had enabled them to learn whenever they needed to and wanted to.

Using learning applications/software as one type of self-directed mobile learning activity was, for these Chinese students, very much like an extension of their school curriculum. They practised quizzes on their mobile devices either to learn new material or revise older content or to complete their homework. Such mobile learning practices, to some extent, can be regarded as indicators of how teaching and learning are embedded in social and cultural contexts. In China, students face extreme pressure and stress in their school experience and are expected to be good at academic learning. The students in this study were trying to deal with the pressure that they were facing in their own way through learning with mobile devices. Apart from the stress and pressure of examinations, the influence of Confucian values on the attitudes toward learning and achievement of these Chinese students can be seen. Most Chinese people place a high value on learning (Watkins and Biggs 1996; Li 2001) and both parents and students express the belief that learning achievement can be met as long as sufficient effort is put in (Hau and Salili 1991; Li 2001). The findings of this study suggest that students, when given access to mobile learning devices, direct efforts towards trying different learning practices which can help with their understanding and achievement.

However, the mobile learning practices in which these students engaged involved more than just the extension of the school curriculum. The students described how they chose quizzes for specific topics or knowledge about which they wanted to have deep understanding. Such quizzes could be amended either based on their results or on their own judgment of their grasp of knowledge. It seemed that their ways of learning with mobile devices were becoming more personalised, a concept which is somewhat at odds with the philosophy underpinning their school experiences. Using mobile devices for learning practices had enabled these Chinese students to be less passive in their approaches to learning. With the injection of mobile devices, the typically perceived characteristic of Chinese students as passive learners (Watkins and Biggs 1996) had been affected by their self-directed learning practices. It appeared that they were beginning to get into the habit of using different means and methods to meet their learning expectations and needs. In this study, students were using new processes of learning by using online forums, learning software and assistant applications. In these learning processes they were assessing their own performance, finding information, evaluating and connecting information to previous knowledge rather than relying on rote-learning and memorisation (Ballard and Clanchy 1991; Ho et al. 2001). The students realised that they had to be critical about the information they found through mobile learning albeit that this may have involved simply downloading pictures. Completing quizzes and getting information are only a part of mobile learning practices. What is more important is to develop the ability to evaluate whether the provided analysis is right and thinking about other perspectives to solve questions. The mobile devices and mobile learning application/software provided these Chinese students, on one hand, with a new platform to assist them with deepening understanding of materials. On the other hand, the students' notions of learning and the learning process had been changed within the mobile learning environment.

The notion of problem-solving or problem-based learning was reflected in these Chinese students' implementation of mobile learning, which is not very common within the traditional authoritarian studying environment they were used to. Students in the study were acting as active learners to use mobile devices to solve problems that they did not understand and were interested in. Both types of mobile learning practices that the students experienced with their mobile devices were based on the concept of problem-solving learning or 'learning by doing' (Buckingham 2008) instead of accepting what teachers transmitted to them (Chen 2007). The data suggest that these students acknowledged their own responsibility for solving the problems they had been set or had set themselves. For curriculum-based mobile learning practices, they used mobile learning applications to overcome weaknesses in their knowledge.

With regard to interest-based practices, these students went beyond disciplines and, rather than sitting in the classroom being lectured, they were exposed to online groups with like-minded members with different backgrounds in which conversations and meanings were generated. Within these online groups, what students did was more than connecting prior knowledge to information for decision making. As students claimed in the study, they posted questions on the forum to get answers as well as providing help to others by joining in interactions. During the process of solving problems, they consumed information offered by other group members and shared information with others to keep continuous conversations going. In a traditional learning environment, discussion happens in fixed settings. It is worth pointing out that mobile devices with a wide range of web-based tools or features provide learners with opportunities to join in conversations whenever they accessed something useful related to the problem. More importantly, it appeared that problem-based learning in the mobile learning environment helped these Chinese students cultivate their long-term self-directed learning skills (Barrows 1986) in the digital environment. From what they said, these students valued the skills they gained through interaction around the solving of problems. They demonstrated that skills with mobile devices on self-directed learning would be useful when they entered higher education where they would have more freedom and flexibility in their learning. It seems that mobile devices may become a powerful vehicle to affect Chinese students' learning habits and concepts of learning in the long run.

As discussed previously, these students' mobile learning practices were embedded in a Chinese social and cultural context. Chinese students are recognised as highly extrinsically motivated learners rather than motivated intrinsically (Smith and Smith 1999). In this study, these Chinese students were found actively participating in self-directed mobile learning processes within the influence of environmental factors such as a highly competitive society and an examination-oriented education system (Lau and Chen 2013). Students in the study adopted mobile learning applications or used software for curriculum-based learning with the purpose of self-improvement, good preparation for examinations and higher scores. As they explained, Chinese students had to be well prepared in order not to be left behind within the competitive environment. They wanted to try different ways of learning in order to become more competitive. Students believed that their curriculum-based learning was quite helpful for both examinations and understanding of knowledge. It can be seen that to some extent, extrinsic motivations relating to academic or career development should not always be regarded as having negative effects (Xu 2004). The perceived usefulness of mobile learning practices among these students could in return be represented as a type of intrinsic motivation.

It was noticeable that these Chinese students were found to be intrinsically motivated within their curriculum-based mobile learning practices when they chose to increase the difficulty level of quizzes as an optimal challenge. Such goal-oriented/driven activities can be considered as intrinsically motivated (Malone and Lepper

1987) because of the sense of fulfilment and enjoyment that participants achieved when they reached the level they set. Apart from this kind of challenge, these students were also identified as intrinsically motivated learners when they used mobile devices to participate in learning practices based on their interests. They enjoyed their learning process on the online forum or in interest groups especially when they could interact with each other with the exchange of information and use of feedback. The enjoyment which emerged from these mobile learning practices enabled them to make creative contributions to interactions. In a traditional learning or non-mobile learning environment where learning tends to be linear and fixed, Chinese students may not often experience such intrinsic motivation. The flexibility of mobile learning for self-directed learning practices, additionally, stimulated a cognitive curiosity for learning (Ciampa 2014; Traxler 2007). In the study, therefore, this group of Chinese students were found not only extrinsically but also intrinsically motivated through self-directed mobile learning.

They were also found to some extent to have become autonomous learners. Their ability to arrange independently the time and direction of their learning practices can be counted as aspects of learner autonomy (Benson and Voller 1997; Joshi 2011, Ting 2015). However, the students' mobile learning practices were affected or restricted by their ownership of mobile devices. Students who did not have personal mobile devices had the tendency to carry out simple mobile learning practices using borrowed devices. They complained that they could not fully engage in mobile learning practices because their parents usually set a time limit or even sat beside them. This could be one of the current challenges of mobile learning. It seems that some parents are not quite convinced by the potential transformative effects of mobile devices on their children's learning (Shuler 2009). With the competitive educational system in China (Mok et al. 2007), it would not be easy for parents to be so convinced in the short term, although getting parents to support their children's autonomy in terms of availability of mobile devices and power of being in charge could positively promote academic motivation (Chirkov and Ryan 2001).

Some concerns that students mentioned suggest other challenges of mobile learning in the Chinese context. Chinese secondary school students who are under the 'influence of a high-stake public examination' (Lau and Chen 2013, p.1096), for example, the 'GaoKao' (National University Entrance Examination), would not expect their independent thinking capability would be affected because of getting into the habit of using mobile devices for answers. However, using software/applications on mobile devices cannot be counted as successful mobile learning unless learners reflect and learn new things or deepen their understanding through it. In this sense, it could be seen that learners' perceptions of what counts as successful mobile learning could affect the adoption of mobile devices for learning. This concern also raises the question of the need to provide students with appropriate support and guidance for mobile learning, especially for Chinese students who tend only to be exposed to paper-based and fixed learning settings.

How to use mobile devices for learning effectively without causing too much pressure appeared to be another challenge for these Chinese students' self-directed mobile learning. Students in the study would sometimes face inappropriate challenges and felt depressed when they selected a difficulty level far beyond their grasp and understanding. This could lead them to be reluctant to use mobile learning if they felt pressured in their learning. This pressure might negatively affect students' beliefs about mobile learning. Apart from the issue of difficulty level, the findings showed that Chinese students also faced accumulating problems as they engaged with mobile learning practices. Mobile learning does not merely refer to using mobile devices for learning. It is more about 'learning on the go' (Corbeil and Valdes-Corbeil 2007; Traxler 2007) within an internet-connected environment. Therefore, regardless of the availability of mobile devices, sufficient guidance and direction about, for example, learning strategies needs to be made available for students. Such guidance could be delivered efficiently through teachers using mobile devices within their classroom teaching, thereby helping students to combine school and home learning.

7.7 Limitations

Changes of learning practices and notions of learning with the injection of mobile devices in China cannot be fully and well explored within such a small-scale, short-term study as this. Previous studies of mobile learning practices and motivations (Rau et al. 2008; Su and Cheng 2015) have revealed other issues through the use of larger scale samples and it is hoped that the current study complements these larger scale surveys.

Because of limited time and practical difficulties, the beliefs and perceptions of teachers and parents toward using mobile devices for learning were not the focus of this study. These seem to be a key area for future investigation as we attempt to gain a broader understanding of the effects of self-directed mobile learning on students' learning practices.

7.8 Conclusion and Implications

This case study has provided an in-depth view of the self-directed learning practices of a small group of Chinese students using mobile devices in out-of-school settings. Together with the exploration of motivations, autonomy and perceptions, the study also enriched our understanding of the change of learning practices in a Confucian Heritage-driven education system such as China implied by the injection of mobile devices. Chinese students were found to engage in learning practices which could loosely be termed problem-based learning and to operate with both extrinsic and intrinsic motivations.

It seems, from the study, that mobile devices can to some extent stimulate learners' intrinsic motivation for certain features of a mobile learning system. Intrinsic motivation is generally regarded as positively related to learning engagement and outcome (Pintrich and Schunk 2002). Following this perspective, it would be useful for researchers who are devoted to mobile learning system design to take motivation factors into account to achieve engagement and expected learning outcome.

It is a bit tricky to guarantee parents' support for students' autonomy and self-directed learning with mobile devices because Chinese students are currently in a trial stage of mobile learning in their highly competitive situations. Further studies regarding parents' perceptions of mobile learning are needed. Meanwhile, it is not easy for students to gain mobile learning strategies with self-directed learning. Carefully designed modules in school with an integration of mobile learning could be a good way to help students to gain strategies for learning with mobile devices.

Concerns mentioned by students in the study indicate some challenges that students might come across when experiencing self-directed learning with mobile devices. Understanding these challenges, and the potential factors that may affect the acceptance of mobile devices for learning, is crucial if we are to help students to overcome the challenges of employing self-directed mobile learning practices within a rigid and examination-orientated educational system.

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Chapter 8
Outdoor Learning with Apps in Danish Open Education

Theresa Schilhab and Gertrud Lynge Esbensen

8.1 Introduction

Worldwide, the use of digital technologies by children and young people for learning, seeking information, social contact and entertainment is on the rise. In Denmark, so-called iPad schools have switched traditional books for tablets, one pupil per device, introducing smart technology as an aid in formal learning (Khalid et al. 2014; Schilhab 2017a,b,c). In addition, 70% of Danish children aged seven to twelve are active YouTube consumers (Mehlsen 2016). They also communicate heavily by exchanging text, pictures and links through social media, such as Facebook, Snapchat and Instagram.

The extensive use of technology coincides with a decline in outdoor experiences (e.g. Zahl-Thanem et al. 2018), which has been popularised as 'nature deficit disorder' (Louv 2008). Although parental barriers such as increased perception of 'stranger danger' (Foster et al. 2014), increased traffic volume when commuting to school (e.g. Huertas-Delgado et al. 2017) and tight time schedules (e.g. Skar et al. 2016) also create barriers for children's exposure to the outdoors, technology-based communication and indoor activities often seem to replace learning and playing outside. Hence, informal learning from direct experience with nature is replaced with another type of informal learning that focuses mainly on communicative skills and digital literacy. Here, we explore the extent to which app technologies may engage children in informal open education (e.g. Hirsh-Pasek et al. 2015).

In the scientific literature, arguments for exposing children to nature are diverse, although they generally share an underlying premise that nature experiences are

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overwhelmingly beneficial. From a health perspective, playing in nature is argued to be good for children because their level of physical activity increases in natural environments (Janssen and Rosu 2015; Raney et al. 2019). Also, when children play in natural environments, it is argued, their motor skills are improved (Fjørtoft 2004). Other studies argue that nature experiences build resilience and mental health in various ways (Bakolis et al. 2018; Cervinka et al. 2012; Engemann et al. 2018; Swami et al. 2018). For example, according to Attention Restoration Theory (ART; cf. Kaplan 1995), nature improves our cognitive performance by alleviating the burdens on the directed attention typically required when we perform academically (Diamond 2013) and when mental tasks require us to concentrate to pursue abstract thoughts or build mental models (e.g. Schilhab 2017a). Following ART, natural surroundings engage us by soft fascination (Berman et al. 2008; Berman et al. 2012; Stevenson et al. 2019), triggering the involuntary attention system that takes no mental effort to activate (e.g. Faber Taylor & Kuo 2009; Sood and Jones 2013). Therefore, time in natural environments allows directed attention resources to restore (Schilhab 2017c; Schilhab et al. 2018b). Another important line of studies suggests that resting in nature relieves stress (Cox et al. 2017; Logan and Selhub 2012; Swami et al. 2018; Wells and Evans 2003).

From a subjective perspective, people seek nature experiences to find peace and quiet (Gullestad 1989), but this outcome does not pertain to everyone. Using an Implicit Association Test to explore the degree to which subjects associate themselves with the natural environment, Schultz and Tabanico (2007) find that approximately 75% of respondents find it easier to associate themselves with nature than with built environments, whereas the opposite pertains to the remaining subjects (p. 1222). However, Carlone et al. (2015) show that youth's self-images regarding whether they see themselves as not 'outdoorsy' or 'animal kinds' of people are changeable through learning processes.

From a broad learning perspective, being in nature provides opportunities for experiencing, sensing and learning to understand one's surrounding world (Maynard and Waters 2007; Schilhab et al. 2007). Carlone et al. (2011) argue that besides the acquisition of skills and academic knowledge, learning about nature includes learning new ways to view our natural surroundings, to be curious and to ask new questions about our environment. In a literature review, Taylor and Kuo (2006) argue that nature also supports children's social and emotional development. In support of this, Skar et al. (2016) find that when given time to free play in a natural environment, children acquire closer and more embodied nature contact—and more 'nature happiness'—than when adults organise predetermined activities (p. 537). Also, Stordahl et al. (2015) find that nature gives all young children a rich and stimulating play environment with natural motor and mental challenges. They further argue it is important for children to learn how to interact with nature and for adults to take part in these learning processes, helping children to feel safe and encouraging and supporting their exploration of nature (see Schilhab 2007, 2015a, b, 2018).

The perspective of learning to understand one's surroundings is closely related to the learning-to-care perspective, which argues that if we want future generations to protect the environment, they first must understand basics about it. For example, Chawla (2007) argues, there are well-known connections between care for nature and childhood experiences of being in nature with family and other caregivers, suggesting that children may need to be socialised into the caring perspective. Carlone et al. (2015) contend that youth need to learn to recognise the rich biodiversity in their immediate environments and need to protect habitats and the environment. They frame this need as a social justice issue for all youth to spend time outdoors, learning about and connecting with nature nearby. Kahnet al. (2009) studied children's environmental reasoning and values, interviewing children living in four different settings to show that animals, plants and caring for nature are important to children. This is similar to the 'Fridays for Future' initiative the Swedish teenager Greta Thunberg launched, which resulted in an international climate strike at schools on March 15, 2019.[1]

8.2 Does the Use of Technology Hamper the Effects of Nature?

In summary, the literature suggests that children and young people benefit from experiences in the outdoors. Notably, however, outdoor experiences include both group activities around a campfire in the woods and walking the dog in solitude along a residential road. Also, 'nature' is often used synonymously with the outdoors, collapsing the experience of resting in a forest with experiences of urban parks and trips to the beach, even though these may differ both in terms of the particular natural phenomena and the significance attributed to them (their sociocultural value; cf. Schilhab and Esbensen 2019). Nevertheless, within the scientific discourse, nature experiences seem to be shown to entail better understanding of a person's surroundings, often by way of informal and playful learning processes that implement full-body as well as mindful activities. Although explorative, this understanding may ultimately lead to a better grasp of concepts within natural sciences education (Niebert et al. 2012).

In light of this, a tension seems to exist between playing outdoors in natural environments and indoors using technology (e.g. Frost 2012). Condensing the literature review above, nature is thought to relieve the use of directed attention by endorsing soft fascination. This sustains both informal learning about how the natural world works and a caring attitude. The premise here seems to pivot around the issue of attention. How does smart technology and its ability to engage attention on one user, one device basis fit with this picture? To what extent do informal learning processes depend on attentional properties of the learner? Another lingering issue concerns how to conceive of informal learning processes. Here, we assume that

[1] https://www.nationalgeographic.com/environment/2019/03/kids-climate-march-strikes-around-the-world-fridaysforfuture/ & https://www.theguardian.com/environment/live/2019/mar/15/climate-strikes-2019-live-latest-climate-change-global-warming & https://www.fridaysforfuture.org/

learning about natural phenomena onsite, in a situated and bodily involved setting, count as informal learning, even though elements of this learning process may be shared with formal learning (Schilhab 2018).

Hence, we argue that the divide between nature and technology may not be carved in stone. In open education scenarios, technology could recruit children to have more informal learning experiences of the natural world (e.g. Schilhab et al. 2018a, b). To decide whether technology use in nature is in fact deleterious to experiences of nature, we need to analyse the relationship in more detail. In this paper, we propose a taxonomy of apps, explored using a mixed-method design (Christensen et al. 2011). We use our findings to consider the question of the extent to which informal learning using digital technology contributes to direct experiences with and understanding of nature.

8.3 Natural Technology

Here, we report on a five-year research project, ‘Natural Technology’, we started in 2018 (Schilhab et al. 2020). The project emerged from the hypothesis that smart and other forms of technology, including drones and battery-driven scooters (which are not relevant for this chapter), may stimulate children and young people (6–18 years) to have more experiences with nature. Smart technologies, such as tablets and smartphones, have been on the market and used by children and young people for the past decade (Hjorth et al. 2012). New apps emerge constantly, so knowledge is lacking about their capacity to recruit children to increase their experiences with the outdoors. Natural Technology aims to provide insight into *what* kinds of app (e.g. encyclopaedic info, apps for play, apps for registering) exist, and *how* these stimulate children and young people (through, e.g. bodily engagement, community involvement, increased memory processing, physical activity) to engage more with the outdoors. Therefore, we explore both the social arenas (e.g. friends, the school, parents, leisure activities, video channels, social media) in which children are introduced to technologies and the kinds of stimulations these seemingly offer to children and young people.

The project comprises three work packages: (a) a taxonomy of apps (which is the topic of the current chapter); (b) children’s and youngster’s use of smart technology in organised and freely chosen activities; and (c) social media use instrumentally to recruit for nature experiences.

The taxonomy of apps uncovers, documents and analyses the kind of app technologies children and young people implement in their outdoor activities, including both apps children find themselves through social media or hearsay and apps introduced by adults in formal education and leisure activities after school. The methodology used to establish which apps exist and for which purposes entails ‘digital ethnography' (Collins et al. 2017; Varis 2016; Pink et al. 2016),[2] internet-based questionnaires and sustained telephone and Skype interviews.

The taxonomy presented here is organised from the perspective of intended use as described by the manufacturer and informants in eight major categories. Although we are fully aware that the actual use of technologies often diverges from and expands beyond a manufacturers' initial intentions (Bijker et al. 2012, Papadakis et al. 2017), since we aim to understand basic relations among experiences of nature, informal learning processes and technology use, we merge the two perspectives here. Thus, our primary interest is to understand the extent to which technology influences the informal learning outcomes attributed to experiences of nature. Therefore, we discuss the categories of apps in relation to how they may assist learning processes and to what extent these effects align with the supposed beneficial effects—especially the attentional and caring effects—of experiencing nature.

8.4 Methodology

This study crosses disciplines—neurobiology, philosophy, anthropology and educational research—so we use a mixed-method approach to accommodate all relevant perspectives. As Christensen et al. (2011) argue, one single method cannot accommodate the complexity of contemporary social science research questions.

Often, when apps are studied, the point of departure is a specific app, such as Pokémon Go (e.g. Dorward et al. 2017; Kogan et al. 2017; Ruiz-Ariza et al. 2018). However, for this project, we initially wanted to collect knowledge about which nature apps exist, who uses them and for what purposes they are used. The endeavour is challenging because Natural Technology users, our 'target group', are not homogenous per se. Rather, they are niche-specific, fiery souls from various backgrounds: school teachers, scouting leaders, biologists, athletic coaches, artists, nature guides and pedagogues, as well as youngsters who happen to be interested in how the experience of nature or the outdoors combines with technology. From initial conversations, it became clear that technology very often plays only a small part in activities with other main purposes.

Hence, our data collection entailed both broad web searches on Nordic nature, education and sports communities and searches of Google's and Apple's app stores for nature apps and key people. Simultaneously, we announced the project through several articles in Danish media, requesting practitioners and app developers to make contact. We also contacted approximately 3000 schools and youth education programmes about the project, calling for interested practitioners. We recruited large national scout organisations to inform their participants about our goal to share knowledge concerning how technology is used in nature. Simultaneously, we

[2] Digital ethnography is a broad field interested in how "the digital has become part of the material, sensory and social worlds we inhabit" (Pink et al. 2016, p. 7).

built a web page to communicate with practitioners, users, potential future users and technology developers. Additionally, we have continuously communicated through the press, on a blog, by giving talks and by participating in relevant nature events, such as the annual Danish People's Festival of Nature.

To gain a broader perspective on what exists and is used in Denmark in 2018–2019 and to make contact with relevant users, we conducted a short web survey presenting apps we found and asking about apps missing from our list. The survey was posted on Natural Technology's Danish Facebook page and our project webpage, leading to 92 responses and a lot of tips about apps, as well as interviews.

By April 2019, we had also conducted 19 initial five-minute interviews by phone or mail and 10 in-depth interviews lasting between 45 and 90 minutes. All in-depth interviews were recorded and subsequently transcribed. In line with the General Data Protection Regulation (www.eugdpr.org) and well-established ethical guidelines (European Commission 2018), interviewees received email about the project, its purpose and their rights prior to their acceptance to be interviewed online and were asked their permission for the interview to be recorded.

This work led to a collection of 97 apps (and 13 technologies outside the app category). All were developed for or are being used outdoors with children and youngsters in Denmark or Scandinavia in various ways. As we discovered apps and other Natural Technologies, dynamical analytical patterns emerged.

8.5 Results

The taxonomy of apps presented here is divided into eight major categories: (a) encyclopaedic; (b) registering; (c) citizen science; (d) food finding; (e) play; (f) movement; (g) artistic; and (h) tools (Table 8.1).[3] These categorisations are based on information provided by the developers and then qualified by relevant sources within our directory of data. We taxonomise according to the primary function, even though some apps combine two or more purposes and therefore equally fit more than one category.

Encyclopaedic apps (E-apps) provide instructional texts on topics concerned with the identification of flora, fauna, sky and sea. They typically follow the traditional lexical format, arranging content alphabetically, which is often exploited by integral search functions. They include such apps as virtual bird and animal books, star maps and sailing encyclopaedias. Other E-apps contain image recognition functions, which make them highly usable on the spot: from a photo of a particular leaf, flower, tree or mushroom, the app provides similar photos along with botanical names, suggesting stored images to assist in the identification of the find. Hence,

[3] We have left apps out of our inventory that are more tangential to the nature and technology theme.

E-apps elicit a kind of ‘naming’ activity that may increase the user’s sense of familiarity with the environment.

Registering apps (R-apps)[4] inspire users to register their findings in nature in various ways. For example, the user may be encouraged to list particular species of insects or organisms found in water pools. The app may help the user to archive or catalogue her findings and may even expand listing functions to include seasonal archives to increase the user’s understanding of ecological characteristics.

Citizen science apps (C-apps) take the R-apps one step further. In addition to the private archiving of nature experiences, C-apps provide the user with the opportunity to contribute to charting the environment at large. Often, these larger scale projects are discussed as archives of importance to society in general and may be led by academic or public interests that need representative data or feedback from local eyes on issues like pollution, new species or trees worth saving. Typically, the user reports findings into a cloud database shared by other community members or by parties in charge of the body of data. C-apps may help citizens learn about and feel at home in their communities. Encouraging the citizen to explore in a directed search may simultaneously induce a sense of meaning and connectedness.

Food finding (F-apps) merge encyclopaedic information with learning of skills, understanding of the local environment and cooking activities. Browsing for eatable resources like mushrooms or berries introduces an attitude of familiarity and gratitude towards the surroundings. Ultimately, when preparing and ingesting the meal a highly sensual bond with nature is formed.

Play apps (P-apps) engage users in playful activities with the goal of entertainment. This goal is often achieved by providing access to multiple participants at once. For instance, individuals may use P-apps to follow a route and solve tasks at certain posts in competition with other teams in different types of treasure hunts. They may catch prehistoric animals, ghosts or monsters. P-apps may also take the form of old-fashioned games like ‘hide-and-seek’ or orienteering, where the digital devices supplement with maps. They traditionally encourage walking through geopositioning-system functions on a background of more- or less-developed storylines. An example is the mobile dog, in which the child is given a dog that needs to be cared for by going for walks. Although game attributes like rewards and granting of territories and points for walking certain distances are part of the activity profile, the actual aim is to facilitate physical activity. In addition, children are reminded of what it involves (activity-wise) to be a dog owner, as inactivity in the game is met with notifications about the chores. Besides endorsing activity, the mobile dog app increases the user’s geographical knowledge. When walking streets in the neighbourhood, putative territories are created and marked so that the child is informed about the local area. P-apps often work irrespective of specific locations; it could be argued that they are therefore associated with nature in terms of spatial demands.

[4]Although apps in this category are rare and therefore collapsed with C-apps on the website, for analytic purposes we describe them here as an autonomous category.

Movement apps (M-apps) encourage the user's level of physical activity, for example, by providing hiking, running, orienteering or cycle tracks or by guiding and supporting training. Some also use elements of play for motivation, typically, however with an explicit focus on high-intensity activity. For example, there may be route-following and task-solving here in competition with other teams, mixing fun, activity, collaboration and nature experiences. In another case, a run is made meaningful through a post-apocalyptic framing story where the user is escaping zombies.

Artistic apps (A-apps) introduce the user to creative activities based on electronically stored items, such as sound recordings, images or videos. Hence, A-apps offer programmes to manipulate, communicate and share personal items. Images, sounds or video clips of experiences in nature may be integrated into diaries, digital books or videos shared on social media.

Tool apps (T-apps) provide the user with a digital version of a particular tool that is instrumental in focussing on or addressing experiences in nature. They may be extensions of the senses, like magnifying glasses, or various measurement tools, such as one that measures the height of a tree when the phone is pointed in that direction. Step sensors or gyroscopes are also included in this group. T-apps typically provide technologies which have hitherto been purchased independently but in contemporary times have been integrated into mobile phones.

8.6 Discussion

The categorisation presented here makes clear that the properties of informal learning have different forms among the apps. While E-, R-, C- and F-apps all arguably operate with some kind of engagement with the natural setting experienced onsite, the other types of apps may not have this feature. The extent to which the app facilitates engagement with the environment seems important to the question about the potential of app technologies to facilitate the experience of nature. Since smart technologies have been shown to redirect attentional processes about the immediate environment to the screen (for instance, Lee et al. 2014 describe how smartphones are checked for messages and updates not because of notifications but out of habit; see also Przybylski and Weinstein 2013; Radesky et al. 2014; Turkle 2015), the question is whether the apps still allow informal learning processes. Here, we assume that the process of informal learning that leads to understanding of the environment and stimulates caring attitudes depends on time spent attending to the environment with soft fascination.

Hence, E-, R-,C- and F-apps all encourage the user first to attend to the environment and then to use the respective app to obtain what could be viewed as scholarly information of sorts. Hence, the apps presuppose actual engagement with natural phenomena and occurrences, although this interaction may be viewed as rather focused on selected parts of the environment, such as particular leaves, insects or birds. E-, R- and to a lesser extent C- and F-apps then primarily engage using traditional learning algorithms in formal learning activities that frame and expand the user's familiarity with the environment through discursive knowledge. Superficially, such activities help the user connect with the environment through what seems to be an object-naming activity (e.g. Pulvermüller 2005). From the perspective of a situated, full-body experience, the activity these apps promote therefore appears quite formal.

On the other hand, the user must be susceptible in the first place to objects like leaves and mushrooms to either look them up in E- or F-apps or register them via R-apps. Hence, the user is initially sensuously and bodily immersed in a full-body experience. Such mental activities are well-known to be potentially quite short-lived from the perspective of recall, because the imprint desiccates in the next moment. In the case of R-apps, however, the archiving activity forces the individual to decide to which category the object belongs, identify similarities with other category members and associate information about location and time, which deepens the encoding and understanding of the object. The deliberate activity of writing down and listing the object, adjusting the record and noting time and location coordinates could be viewed as so-called material anchors (Hutchins 2005). Concrete activities facilitate understanding and memory (Kirsh 2010), improving later recall (e.g. Clements 2000; Schilhab 2017b, Schilhab et al. 2018a, b). So, ultimately, it could be argued that the initial embodiment of the experience that seems to accompany the state of soft fascination may gain lasting significance through these more formal activities.

C- and F-apps are similar to R-apps but may additionally introduce emotional processes that support the effects of the learning event (e.g. Rudy 2008). Reporting back on phenomena in the environment presupposes a responsive community. Hence, the learning activity becomes meaningful through the social pointing and sharing involved (Hasse 2016). Moreover, framing the registering as a culturally approved act of conscience (for lack of a better word) emphasises the meaningfulness of the registering, hence likely further increasing the learning effect of the activity. F-apps also offer highly engaging activities. Searching food sources in preparation of meals often shared with family and friends abounds with emotional, social and sensuous tensions resulting in long-lasting experiences with nature. The activity requires the developing of skills which embodies and grounds the learning even further.

P- and M-apps have different purposes, which influence their ability to sustain learning about nature through experience. Unless their operation entails object-naming, they work by exposing their users to nature with a different main purpose in mind. On the one hand, some P- and M-apps could work independently of natural surroundings insofar as they use green environments merely for spatial concerns. On the other hand, the fact that the app-driven activity is realised in green environments makes these apps highly functional with respect to exposure to nature. Notably, to the extent that the play and physical activities allow for pauses, they create opportunities for engagement with nature. Thus, as opposed to E-, R- and C-apps, P- and M-apps may allow better direct contact with nature by sustaining the process of soft fascination without the presence of discordant mental states (Schilhab et al. 2018b). For example, the game may actively draw the attention of the player towards the natural environment, as is the case with stops in Spec Trek (a ghost hunting app), the Danish mobile dog app and Pokémon Go, facilitating associations between maps and certain locations. Children report better remembering their local environments after Pokéhunts. With respect to the building of a sense of familiarity, games with map functions may have effects similar to those of R-apps.

If P- and M-apps afford time for the user to become softly fascinated, they support time off from thinking patterns sustained by directed attention. Hence, P- and M-apps may ultimately corroborate the restorative effects of nature suggested by ART.

Operating as tools, T-apps are especially interesting, because they seem to relate to experiences of nature in two important ways, as proposed by Ihde (1990). Either the technology inconspicuously extends our senses in a transparent relation of embodiment—like glasses—and thereby enhances our experience of nature, or the technology disrupts our relation with the experience because we cannot see through it (known as an alterity relation). In the latter case, fascination with nature is taken hostage by fascination (or annoyance) with the technology.

Although the rest of the apps can sometimes be distinguished by either the embodiment or the alterity relation, T-apps seem to be the category that fits these descriptions the best. T-apps never exist as an end in themselves but are always meant to serve a function in relation to the experience of nature. In that respect, they are comparable to binoculars and old-fashioned cameras, which have always risked an alterity relation.

We have discussed in this section the differences in support of informal learning activities readily available from the form of engagement intended by various apps. However, other factors should also be considered when discussing natural technology apps' ability to recruit children to more experiences with nature.

For example, informal learning processes also seem to occur just from spending time in nature. The full-body experience of nature is likely to result in tacit knowledge about nature as an environment that makes sense without this knowledge becoming available for explicit report. In other words, even if the app-supported activities in themselves do not increase the time spent in soft fascination (as with E-, P- and M-apps), they still have effects that may influence future encounters with nature. Mere exposure, even if lacking in bouts of soft fascination, seems to increase the frequency of contact with nature later in life, as described in the introduction. According to Chawla (2007), children visiting nature with family and other caregivers are more prone to return to nature. One way to explain this effect is that positive encounters with a place incline people to feel comfortable and emotionally attached to the particular environment (e.g. Schilhab and Esbensen 2019).

Many apps are also thought to drive children's motivations, a feature we disregarded in the taxonomy presented here. Obviously, in many cases, the app content—regardless of whether they are E-, C- or M-apps—is overruled by their appeal when it comes to effects on learning. Hence, a scholarly but highly appealing app will likely motivate children to engage in more informal learning than a dull P-app. The extent to which apps' designs and 'storylines' of apps work depends on feedback from their users. Here again, the tests of quality are probably complex, involving components like design, familiarity, difficulty and overall ability to engage.

Independent of actual learning outcomes, any app that makes children return for more nature experiences may be highly valuable.

The effect of implicit familiarity with nature is all the more important given that children may visit nature for completely different reasons than do grown-ups. Whereas adults may seek experiences with nature exactly because it provides peace and quiet and time away from the stressful activities experienced by urban-dwellers, children may to a larger degree seek arenas that sustain their need for social activity.

In that light, apps that recruit children to have more contact with nature exclusively for social purposes may nevertheless functionally cultivate children's preparedness for contact with nature in adulthood.

8.7 Concluding Remarks

This paper presented a taxonomy of apps used in experiencing nature. The taxonomy is based on intended use and qualified by user reports from our data bank. It divides nature apps into eight categories that promote different aspects of informal learning in nature. We discussed these from the perspective of their ability to ignite informal learning and caring-for-nature in relation to attentional resources. Several of the categories sustain more scholastic learning processes, entailing the learning of factual knowledge about nature. This result aligns with the contemporary debate about the problem in teaching of digitalising—using the potential of new technologies—compared to merely digitising —translating existing material to the digital platform. Although essentially scholastic and thus standing in opposition to the idea of soft fascination, since they exploit directed attention resources, the easy connection to the internet opens up intriguing ways to facilitate learning. An interesting example is that of citizen science and food finding apps, which simultaneously stimulate social engagement and sensations of belonging and caring for one's neighbourhood. Implicit to many apps, notably, are ambitions to sustain users' motivation, an important component we did not cover in our taxonomy. Future research on the concept of motivation and the relation with objective criteria is essential to better grasp the potential of particular apps in formal and informal learning.FundingThis research was supported by a grant from Nordea-fonden to TS and the research project Natural Technology (02–2017-1293).

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Chapter 9
Language Track: An Open Education Resource for Supporting Professional Development in Norwegian ECEC Institutions

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9.1 Introduction

In this chapter, we describe the process of the design and implementation of an Open Education Resource developed by the Norwegian Reading Centre to support continuing professional development (PD) for all staff employed in Norwegian kindergartens.

The free open online resource bears the name *Language Track* [Språkløyper] and is one component of a three-part national strategy to improve the teaching and learning of language, reading, and writing in Norwegian kindergartens and schools (Mossige et al. 2016). The focus in this chapter is on the online resource developed for use in kindergartens. The Norwegian Reading Centre aimed to exploit the opportunities offered by the digital platform to produce a knowledge-based resource that would contribute to enhance the ongoing work with children's language learning.

9.1.1 Background – The Need for Ongoing Professional Development in Kindergartens

In Norway, the notion kindergarten [Barnehage][1] was formalized through an act of parliament in 1975, as a common service for children as the first step in their life-long education. The Norwegian kindergarten is open to all children under school

[1] Kindergarten is termed «Barnehage» in the Norwegian languages.

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age. This definition contrasts with the OECD definition where: Early Childhood Education and Care is defined as preschool or kindergarten for children between 3 and 6 years of age (OECD 2017, p. 59f).

Public funding for the kindergarten sector has increased markedly over the past 15 years, enabling a rapid expansion of service provision. The Kindergarten Act (2006) guarantees all children resident in Norway, wherever they may live in the country, a place in a local kindergarten. Most parents enrol their children in kindergarten at the age of 1 year. Children continue in kindergarten until the age of 5 years. In 2017, 91.3% of all children in the age group 1–5 years attended kindergarten (Statistics Norway 2018). While working parents have welcomed this rapid expansion in service provision, it has also brought challenges. One major challenge is recruiting and retaining qualified staff. The proportion of staff with formal education as kindergarten teachers (higher education) is 45.3%, certified youth workers 25.2% and staff without formal education is 29.5% (The Norwegian Directorate for Education and Training 2018). In addition, many institutions are seeking dispensation from the legal staffing requirements. The Government has published several white papers on the need to improve and maintain the quality of the service (Ministry of Education 2016). Qualitatively, good support for literacy development in kindergartens is especially important for particular groups of children: children in low-income families, children with Norwegian as a second language, and children with learning challenges (OECD 2018, p. 12).

Providing opportunities for kindergarten staff to engage in continuing professional development goes some way in addressing these needs. Research has pointed to the positive and strong impact on the children's learning and development when professional development activities are structured and organized, involving the whole staff and over longer duration (Moen 2016; Gotvassli et al. 2012). Staff also report that engaging in such activities leads to change in practice (Gotvassli et al. 2012, s. 65).

Kindergartens in Norway are scattered over the whole country, located in every municipality. Given the challenging geography and staffing requirements, it is especially difficult for staff in small institutions to take time off to travel to in-service courses in distant locations. Professional development provided online is cost-effective, offers flexibility in regards to time and place, expands possibilities for participation, and extends access to a wide range of expertise and resources (Dede et al. 2009; Castaño Muñoz et al. 2013; Kleiman 2004). Fishman et al. (2013) maintain that online provision can be just as good as "face to face" and indeed may have additional benefits. They argue that online professional development promotes reflection, as participants effectively pace the course to their own needs, repeating course components if necessary and more importantly, there is closer proximity to practice.

Subsequently, in 2014, the Norwegian Directorate for Education and Training commissioned the Norwegian Reading Centre at the University of Stavanger to design and disseminate an online solution. This online resource should incorporate substantial content, supported by academic texts, video lectures, video examples of educational practices, combined with reflective questions and exercises for the full staff to try out in practice with the children (The Norwegian Directorate for Education and Training 2016).

Launched in 2015, the online resource *Language Track* has open access, being freely available for all at any time. The content is protected by the Norwegian Copyright Act, which gives the rightsholder an exclusive right to exploit the intellectual property in the work. The resource is research-based and developed in collaboration with practitioners in kindergartens and kindergarten teacher students to promote collaboration between research and practitioners (Jernes and Alvestad 2017; Skattebol and Arthur 2014).

9.1.2 Language Track – Web Page

The web page (https://sprakloyper.uis.no/) firstly directs users to the level of schooling: kindergarten, primary, lower secondary or upper secondary. On opening the kindergarten site, a welcoming page (Fig. 9.1) introduces the user to *Language*

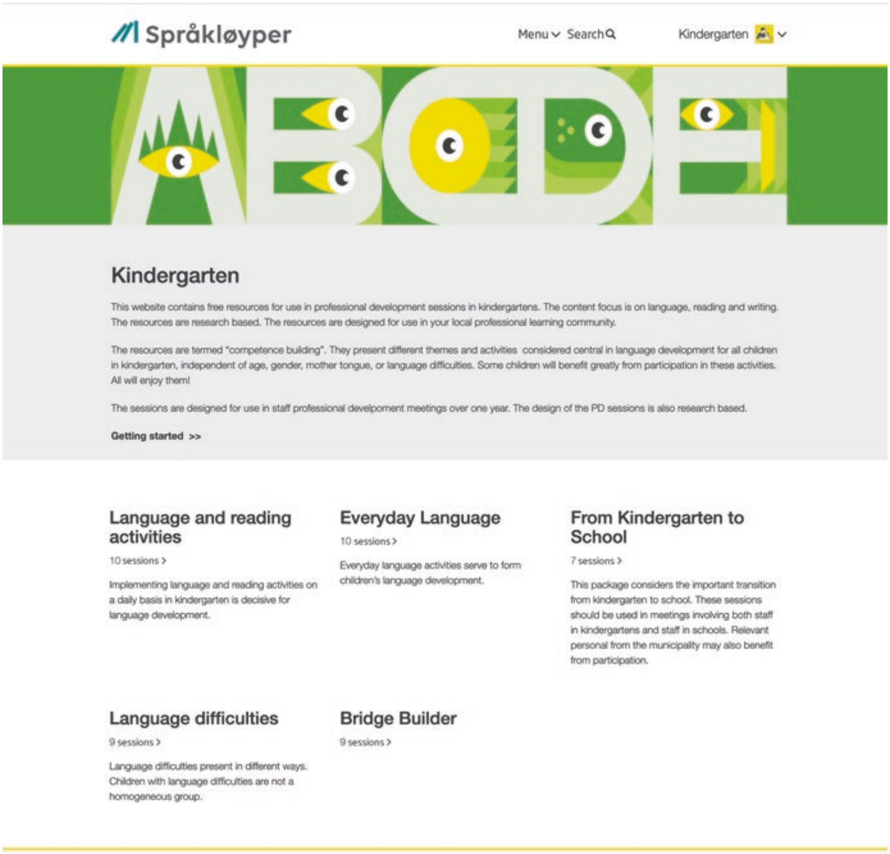

Fig. 9.1 Opening page – kindergarten resource *Language Track*

Track, explaining the aims and intentions and encouraging to fidelity in using the resource regularly in the manner intended by the designers. In order to assist the reader, we have inserted some English language text into the figures.

The kindergarten resource covers five main themes: *Language and Reading Activities*, *Everyday Language*, *Language Difficulties*, *Transition from Kindergarten to School* and *Bridge Builder*. Each theme opens with a presentation of core components and goals. These serve as an introduction to the content and invite to reflection on the kindergarten's existing pedagogical practices, as a foundation for further learning. Each kindergarten can choose the theme that is most relevant for their situation. This possibility to choose supports the autonomy of the kindergarten, demanding reflection over own needs.

Each theme contains materials for up to 10 individual sequential professional development sessions. A session contains a script supported by academic resources such as videos, presentations, texts, critical reflection questions, assignments, and a cover letter with suggestions for organization. A run through of a session, as proposed, will take about an hour, although times specified for each component are recommendations. Kindergartens can adapt the sessions to their own practice, for example, by spending more time on selected elements or tasks.

The intension in the design is that the whole staff use the resource collectively in regular professional development sessions. However, one person will organize and lead the session, preparing any necessary materials in advance. Leading the work is crucial for having success in implementing the initiative (Fullan 2007). Staff gather around a central viewing screen to watch videos and lectures, then divide into groups for discussions.

9.2 Language Track – An Ambitious Resource

There is a growing array of online courses and resources for professional development available (Kleiman 2004). Placing *Language Track* in this multifaceted landscape is challenging. *Language Track* is perhaps closest to Mode 1 as described by Elliot (2017, p. 120), "accessible websites and online resources".

The professional development sessions available in the resource are entirely kindergarten-based. There is no participation in online communities, no synchronous or asynchronous online interactive responses, or discussions with other learners or teachers or other types of support, apart from a free but non-obligatory 1-day introduction seminar offered by the Reading Centre. There is no form of accreditation for teachers or institutions completing the sessions.

However, *Language Track* has ambitions beyond simply providing a database of relevant and interesting materials. The designers envisage that *Language Track* will support the growth of professional learning communities in kindergartens (Buysse et al. 2003). Kennedy (2005) maintains that PD is most effective when it aims to promote autonomy and allows teachers to manage their own development rather than when the aim is simply to transmit knowledge. Three bearing elements in

Language Track are therefore (1) promoting discussion on language, reading and writing, (2) promoting reflection, and (3) encouraging the trying out of news ideas in practice (Mossige et al. 2016).

Both the design and academic content of *Language Track* should work as structuring resources that make it possible and desirable for the kindergarten staff to interpret and act competently in new situations. The mobilizing agency (Coburn 2006) of *Language Track* in relation to these ambitions is dependent on its design and its reception in kindergartens.

In general, we claim that the design of *Language Track* meets the five features commonly associated with effective PD (Desimone 2009; Desimone et al. 2002; Fishman et al. 2013; Garet et al. 2001; Penuel et al. 2007). There is a focus on content and on how children learn, it provides opportunities for discussion and collaboration with colleagues, it provides opportunities for trying out new practices, it offers coherence with the kindergarten curriculum and it offers sequential PD sessions scheduled as a regular event over a longer period. Research related specifically to kindergartens has identified the same features (Vandenbroeck et al. 2016, p. 4).

9.2.1 Language Track – Features and Rational – Our Example

In this chapter, we discuss the design process using a session from *Language Track*, “Digital texts in kindergarten”, (Fig. 9.2) to illustrate. This session is research-based and concerns the use of digital texts in children’s language learning (Mangen et al.

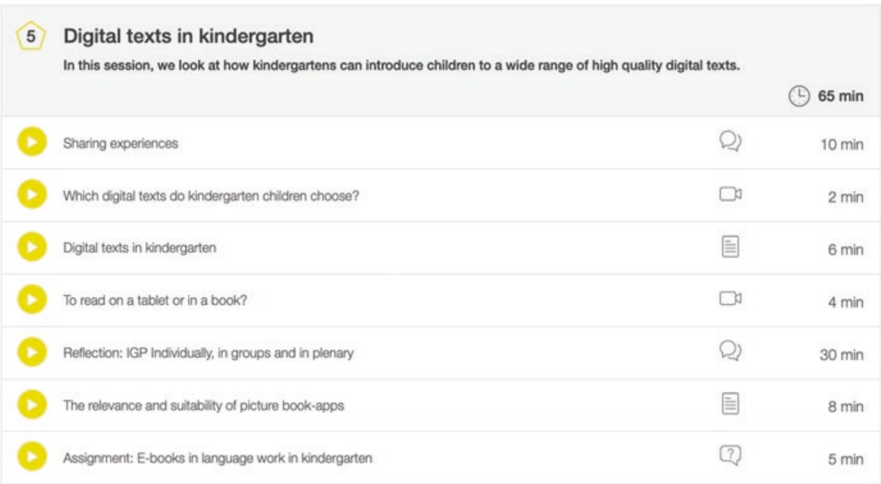

Fig. 9.2 Script for the session

2019). The aim of this particular session is to facilitate knowledge building around the use of digital texts for different pedagogical purposes and to introduce a tool for the didactic assessment of picture book-apps used in shared dialogue-based reading.

Figure 9.2 shows the script for the session with recommended timings. The icons second to the right indicate the modality of each element. These include two discussion, two videos, and two texts and at last an assignment for practising before next session.

9.3 Selection and Presentation of Content

An important principle in *Language Track* is that the content is research-based and theoretically sound. In this session, the academic content stems from findings from a research and innovation project on shared dialogue-based reading of printed picture books and picture book applications in kindergarten (Hoel and Tønnessen 2019; Mangen and Hoel 2017; Mangen et al. 2019; Tønnessen and Hoel 2019).

It is also important that the presentation of the content is not simply a transmission but engages and motivates the staff. Research suggests that teachers often prefer films, practical tips and suggestions and give evaluative responses to these rather than activities that involve reflection and discussion (Abramovich and Schunn 2012; Bates et al. 2016). The digital platform allows for the use of different modalities, to support student-to-content interaction (Dunlap et al. 2007). This session begins with a video showing children using various digital tools. Information boxes present statistics from national surveys on children's access to digital tools and texts, in both kindergarten and home (Letnes et al. 2016; Strømmen 2018). Further, based on hit lists from YouTube, the video presents the most common examples of how young children spend time when using digital artefacts such as tablets and smartphones: they watch other children gaming and playing and they watch "unboxing" videos. This information and these examples may be termed as "triggering" in that staff recognize the importance and actuality of the issue (Dunlap et al. 2007, p. 30).

The second video shows an interview with one of the kindergarten teachers from the research and innovation project. He has used picture book applications in shared reading within the project over several months. In the interview, he tells of his experiences, of the children's participation and engagement, and of his didactic preparation, preferences and reflections. The interview is cross-cut with illustrative video taken during his shared reading activities in kindergarten. Through the interview, he invites kindergarten staff into this practice. The teacher uses language which is both recognizable and inclusive to staff. The teacher tells of his successes, of things he finds challenging, how he reflects upon these challenges, relating theory to practice. In this way, he invites the online "audience" into a learning community.

In this session, there are two written academic texts. The first text ties the theme introduced in the first introductory to the National Curriculum for Kindergarten (The Norwegian Directorate for Education and Training 2017) and to the mandate for the Norwegian Kindergarten. This text provides a supporting rationale for staff to engage in the theme.

The second text "*The relevance and suitability of picture book-apps*" presents the research-based knowledge that underlies the previous mentioned didactic assessment tool (Mangen et al. 2019). It encourages kindergarten staff to assess didactically picture book-apps for use in shared dialogue-based reading with groups of children. The tool addresses seven main topics: (1) theme (relevance for the children who participate in shared dialogue-based reading), (2) duration (number of pages, length of verbal text and playtime of the picture book-app seen in light of the children's age and experience with participating in shared reading), (3) verbal text and illustrations (interaction between verbal text and illustrations), (4) interactivity (considerations on whether animations, sound sequences, tasks are visible or hidden, closely linked to the story or sidetracks), (5) flexibility (opportunities to regulate/turn off sound, such as narrator voice, background sound/music, sound effects and automatic page turning), (6) language play (playful and mood-creating qualities of the verbal language in the narrative) and (7) dialogue (exploratory qualities within the picture book-app).

Such academic texts often employ a language that deviates from the institution's everyday language and communication practices. Both staff in kindergartens and kindergarten teacher students have systematically reviewed and tested the *Language Track* session to ensure that the academic content communicates well. These reviews point out that use of academic terminology can be difficult and challenging. The correct use of technical terms and references is important for strengthening the discipline, but at the same time, texts must communicate with learners. Consequently, we replace some of the academic terms with terms that are more familiar, while explaining other terms explicitly in the context in which they are used. The participants are also encouraged to choose one person to read the text aloud to the whole group, so that any reading difficulties do not stand in the way of understanding. These reviews have also confirmed that the use of real-life examples presented throughout the videos is important in bridging the gap between theory and practice.

9.3.1 Active Learning and Collective Participation

It is important for the designers that the academic content presented in *Language Track* is sound. However, if *Language Track* should meet its ambitions, the recommended methodology for enactment of the resources in kindergartens, it should also rest on a sound theoretical base, encouraging both active learning and collective participation.

The design of *Language Track* leans on a sociocultural understanding of how people learn. In this understanding, learning takes place in interaction between people and in interaction between people and tools/artefacts and each individual's learning occurs in the context of the culture, language, and community (Vygotsky 1986). Within this view, learning is fundamentally social, occurring through participation in a community and language is central in all learning processes. A central aspect of sociocultural perspective on learning is also the construction of own knowledge. Learning is not receiving information through transmission, but creating and constructing knowledge through reflection, activities, exercises and participation (Bruner 1990; Dewey 1997). Learning is a social process whereby knowledge is co-constructed. Offering a variety of tasks as a basis for interaction and the co-construction of knowledge in a social context is a foundation principle in *Language Track*. Our hope is that knowledge created and shared through repeated reflections within the context of the kindergarten, will contribute to competence building and new and improved practices will appear. However, it is first when the reflections are expressed in meaningful pedagogical actions that it is confirmed that learning has taken place (Schön 1987; Säljö 2016). *Language Track* does not offer instruction in good practice, but rather encourages meaning-making within the community of practice (Rogoff 2003).

Language Track encourages active learning. The session scripts always include time slots for staff to participate in shared reflection. After viewing a video or reading a text in plenary, the participants are invited to firstly reflect individually (*I* individual), then in small groups (*G*), where three to four persons share their individual thoughts and decide what they will bring to the plenary discussion. Finally, in the plenary (*P*), the participants present the most prominent considerations from each group. The leader of the session should ensure that all groups present in the plenary. A so-called IGP (individual, group, pleanary) exercise will take around 15–30 minutes, depending on how the leader manages the exercise. We understand and interpret the world from our own point of view and within our own mental models (Senge 2000). Discussion challenges our interpretations and understandings, hence an important exercise in the session. In the videotaped interview in the session (Fig. 9.2), as mentioned, the teacher presents contrasting views and different perspectives on the reading of paper books and on reading picture book-apps. These expressed views aim to provoke discussion, for example, when the teacher argues that children are not as verbally active when reading the picture book-app, compared to reading a paper book. In the following IGP session, the staff individually write down something that either surprised them or made a strong impression from the video-interview. They then share these thoughts in groups, agreeing on the most important aspects in reading digital texts with children, before sharing in the plenary.

The active learning in *Language Track* also extends beyond each PD session. Each session concludes with a concrete assignment for staff to practise in the coming weeks. The task relates to the topic of the session. These assignments create an arena where research-based theory and practice meet. Learning takes place through participation in these social practices (Lave and Wenger 1991). In line with research (e.g. Hammerness 2006, p. 1242), *Language Track* is based on that competence building will benefit from opportunities to practise skills and repeat experiences. Therefore, every session ends with an assignment to encourage practising in own kindergarten, as in our example (Fig. 9.2) is to use the didactic tool for assessing picture book-apps when the goal is shared dialogue-based reading with a specific group of children in kindergarten (Mangen et al. 2019).

Collective participation is another aspect of the recommended methodology for using *Language Track* resources in the kindergarten. This recommendation also leans on a growing body of research that suggests that formation of professional learning communities within institutions supports development and growth (Stoll et al. 2006). Marsh (2000) claims that quality of the collective reflection is crucial for the development of new meanings and understandings in an ongoing training. Staff development "comes not from listening to the good words of others but from principals [colleagues] sharing with others what they know" (Barth 2000, p. 150). Staff are encouraged to read texts (videos or written texts) together and then to discuss their interpretation of the meaning. These texts present examples and different perspectives. As explained earlier, the staff in Norwegian kindergartens are not homogeneous. Designing "inclusive" resources is one of the challenges in *Language Track*. Real-life videos, the use of carefully considered language and providing a variety of texts are different ways the designers have addressed this challenge. The hope is that through targeted work with the resource over time, within the social context of a learning community, the entire staff will develop their competence. The developers and designers cannot enforce or direct this type of participation only encourage through exploiting the modalities available in the platform. The role of the leader is to create conditions for commitment and engagement.

9.3.2 Learning and Change Take Time

We experience that learning, new understanding and implement effective change needs time to grow (Fullan 2007). According to research from Peeters, Urban & Vandenbroeck, in-service training "cannot be resolved by isolated and short-term initiatives, as these have only limited impact on daily practice, if any" (Peeters et al. 2016, p. 134). Practitioners need to discuss and agree on the understanding of the specific knowledge and connect this to theoretical perspectives (Hammarén 1999; Løvlie 2003; Rogoff 2003). Each theme in *Language Track* contains up to 10 sessions that relate to each other, and the work stretches over 1 year (Fig. 9.1). Each session in *Language Track* is designed in such a way as to encourage the kindergarten staff to spend time working with the content. There is also a regularity in the design of the sessions making it easier for staff to fall into a pattern of participation. As shown in Fig. 9.2, each new session starts with 10 minutes sharing experiences from work since last session. This sharing of experiences should help to maintain focus on the work in progress, support collective responsibility, and provide another opportunity for staff to learn from each other (Stoll et al. 2006).

In addition, we argue that *Language Track* is supporting the curriculum for kindergartens (The Norwegian Directorate for Education and Training 2017); hence, support the work and the focus on language learning. The aim for the staff is to achieve a sense of coherence, which is according to Hatlevik and Havnes (2017), connected to their interpretation of relevance of the education, to a feeling of mastering and to understanding of the vision and learning goals. *Language Track* endeavours to maintain a close connection between the curriculum for Norwegian kindergartens and the academic content, ensuring relevance for the practitioners.

9.4 Conclusion

As developers and designers, we see that open online in-service training and education, as in the case of *Language Track,* has possibilities and poses challenges. A weakness with *Language Track* is that it does not provide opportunities for kindergartens to connect either with the university or with other institutions. Studies indicate that social presence has a significant effect on students' persistence, satisfaction, collaboration and learning in e-learning communities (Smith and Sivo 2012) and there is a need for social connection and belonging (Kushlev et al. 2017; Pettersen 2018; Turkle 2011). In a study involving preschool educators, Pianta et al. (2008) found that web-mediated courses are most successful when accompanied by some form of online consultancy, for example, with professionals at universities. *Language Track* does not offer any form of online communication. The success of *Language Track* is dependent on the degree to which the resource supports interaction and knowledge sharing between the local users (Smith and Sivo 2012, p. 873). *Language Track* relies on the local leader to encourage and lead the reflections and discussion within the kindergarten (Peeters et al. 2016).

While it is easy to provide both theoretical and practical justification for *Language Track*, we lack empirical evidence from the field. A recent survey among kindergarten owners ($n = 383$) and kindergarten managers ($n = 921$) report that staff perceive the *Language Track* resources as relevant and useful for work in kindergartens (Bubikova-Moan et al. 2018). However, there is a clear need for long-term studies of the learning outcome in Norwegian kindergartens. These studies should investigate the practitioner's experience of learning when using web-based resource such as *Language Track*, and according to Grepperud and Holen (2015) investigate learning and meaning-making using several modalities as web courses in combination with social meetings and working face to face as when doing in-service training.

Language Track is a dynamic resource, which can be updated quickly and continuously. It is costly both in design and in maintenance. At present, we offer free access, but this is dependent on continued funding. *Language Track* is inclusive, encouraging learning communities including both experts and novices. The resources are knowledge and research-based, exploiting the advantages of the multimodal possibilities within the digital medium, and encourage sustainable professional development (PD) in-service in kindergartens.

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Chapter 10
Multiplying Awareness of Open Practices and Educational Resources

Constance Blomgren

10.1 Introduction

Educators have been working in open education approaches for some time, with its historical ties to the 1880s and the origins of distance education. One could argue that public education for children,[1] despite its imperfections, aligns with the philosophies of open education. Despite this history and the inroads that technology-enabled learning has brought to this current context, educator[2] awareness and understanding of open educational resources (OER) and its broader alignment with open pedagogy (Hegarty 2015) is relatively nascent. This status contrasts to the inroads that OER and its advocates have brought to higher education – albeit a context that still develops but one that has experienced more noticeable changes (Blomgren 2018) than its counterpart involving young students.

As an educator of educators, working at a distance education university I navigate between these two levels of education as part of my professional life. During 2015, I was involved in a process of curriculum redesign for professional learning modules for in-service teachers embarking upon graduate study. Through this redesign process, I sought to refresh this professional learning curriculum and realized that teaching these in-service educators about OER appeared timely and necessary.

[1] The terms used for the system that educates students from the young ages (4 years) to the end of the teen years (up to the date of the 21st birthday in some jurisdictions) varies within the scholarly literature. In the USA and Canada, K-12 has been used but also K-20, etc. In a European context, primary and secondary are used and in the global south the terms vary.

[2] I use the term educator to include the many people who may not be directly teaching children but are involved in the structures that support the classroom context such as principals, head teachers, administrators, and those working in government within portfolios related to public education.

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A. Marcus-Quinn, T. Hourigan (eds.), *Handbook for Online Learning Contexts: Digital, Mobile and Open*, https://doi.org/10.1007/978-3-030-67349-9_10

However, when I began to populate the new modules with additions about OER, I searched the web expecting to locate such content easily available. After trying various search strategies, it was evident that despite my best attempts, what I thought existed was either difficult to locate or was not discoverable. If I looked for such learning resources for a higher education context I was more successful – yet much of this was authored for an American audience, and with an emphasis on OER textbooks (and few educators of children would be inclined to author a textbook, and would more likely want to create and share a unit plan or even smaller learning activities). It was through this search process and the lack of discovering of what I thought existed that brought me to seeing the need for professional learning content about OER for Canadian primary/secondary school teachers.

10.2 Multiply K-12 OER Media Project

OER were first defined in 2002 through examining open courseware as an international educational benefit (UNESCO 2002). Since that time, adjustments have been made and the most current definition describes OER as "teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" (UNESCO 2019, para 1). Creative Commons licenses have six variations upon copyright permissions and are primarily used with open assets. The licenses range from non-derivative and non-commercial to the most open, CC-BY (Creative Commons 2020). Open licenses are fundamental to OER and understanding copyright for educational purposes was one objective of the media project.

The graduate course redesign process coincided with one-time funding from the Alberta government (i.e. ABOER) to create OER for higher education contexts. Through a competitive application process, the proposed *Multiply K-12 OER* media project came into being. Over a 6-month period, a team was assembled including a subject matter expert, a media production company, a project manager, and the talents and knowledge of an assembly of Athabasca University colleagues contributed towards this media project. The overall concept was to interview a list of knowledgeable OER advocates from all levels of education to address questions related to teaching and learning with OER for K-12 educators. The how-to create and share OER did exist on various websites but the *pedagogical thinking* that the use and creation of OER requires was the void that this media aimed to address.

Because we wanted to ensure accessibility – for Canadian educators who may live where internet connectivity is either inconsistent or expensive – the design team supported the emphasis on audio recordings more than videos. In the end, we produced 13 podcast episodes and five copyright scenarios for a total of 18 distinct audio offerings. We also produced three videos that explored the eight attributes of Hegarty's open pedagogy (Appendix B). Although the model originates from a higher education context, the attributes apply, with minor revisions, to the teaching context of younger students. As well, the scholarship of open education for this level of students is only now emerging (Blomgren and McPherson 2018) and theorizing continues to require more time to develop.

Through a process of interviews, primarily through telephone, we assembled the thoughts of knowledgeable OER advocates, including a UNESCO chair of OER, Rory McGreal. Rather than having each interviewee answer the same questions, we selected from our generated list, and when necessary created new questions to address the specific contexts of our interviewees. From these transcripts, we looked for broader themes, wove together interviewee-themed responses and eventually determined the following episodes (Appendix A).

These audio recordings provide the names of the interviewees as well, enabling students to listen for an individual's thoughts on a topic (e.g. *Learning with OER*). Transcript documents provide another format to access these audio recordings. The decision to make podcasts lowered production costs and increased the reach of who we were able to interview and, in some ways, provided a longer shelf life than video. The principles of Universal Design for Learning (UDL) were addressed when creating the video, including the player software and its ability to have closed captions and variations in playing speed.

As we neared the project deadline, we opted to house the media on an existing word press site. Over time, the *Blended and Online Learning and Teaching* (BOLT) website has grown to include other professional learning about OER, including the archives of two virtual conferences (2018 and 2019) that remixed the Scholarly Publishing and Academic Resources Coalition (SPARC) OpenCon conferences for an audience of educators of primary/secondary school. Within the two conferences, the invited speakers addressed the following topics: awareness of OER; pedagogical implications of OER; benefits and challenges of teaching with OER; the role of teacher-librarians for OER success; and systemic supports with an in-depth look by Barbara Soots, OER Program Manager, Washington State Office of Public Instruction. The BOLT website also houses a curated Symbaloo linking to websites (e.g. OER Commons) and OER learning opportunities such as the Commonwealth of Learning online module, *Understanding Open Educational Resources*. As a Canadian, the tension with the Symbaloo curation hinges on the web domination of American educators in creating OER for primary and secondary learners and the degree of editability for revisions or remix, notwithstanding the types of Creative Common licenses involved. *OER Commons* has a tile on the Symbaloo because it is an OER library that is one of the best options currently available for primary/secondary teachers. It allows linking to websites and therefore the lessons and learning activities shared on *OER Commons* have variations in the types of CC licenses and may also link to digital, copyrighted material. The *OER Commons* example highlights the messiness that educators encounter when seeking OER due to the degrees and of understanding of licenses and open practices and reinforces the need for ongoing professional learning in this area.

Since 2016, the awareness and understanding of OER within primary and secondary schooling has been growing and the BOLT website continues to receive new and repeat visitations. The desire to grow an OER teacher network within Canada persists but at the current time remains a wish more than a substantial reality.

10.3 Initial Purpose

Filling the void of absent content regarding OER for pre-service and in-service teachers was the broad goal for this media project. Although educational publishers have traditionally played a role when a gap in learning resources have appeared, these publishers are reluctant, at best, to participate in helping educators learn more about OER, whether they are preservice or in-service teachers. In fact, the lack of OER awareness by these educators – which also translates to minimal OER use and no ground swell of advocacy – could be argued as counterproductive to the billions of dollars worldwide that are annually spent on publishers' educational products. The economic term *monopsony* explains this situation – describing a market where one buyer exists and referring not to the number of suppliers but the number of buyers, with business to government contracts as an example (monopsony n.d.). The buyer (i.e. governments, as *public* primary/secondary schooling fiduciary decisions tend to be at a government level) is only beginning to understand that essentially one purchasing option – closed copyright – has been the single choice due to the legacy of print educational resources. However, with the rise of open licenses and the affordances of digital and participatory technologies, the legacy model of closed copyright for educational resources is being questioned.

From this context, the initial purposes of the media project were to support the following aims:

- Increase the awareness of OER by educators
- Encourage the use of OER through application of the 5Rs (retain, reuse, revise, remix, redistribute)
- Highlight the benefits of OER and openness in education
- Attend to the pedagogical thinking that OER initiates
- Encourage informed educator response to the shifting landscape of educational resources (i.e. non-digital and digital, closed, semi-open and open)

These purposes have not grown out of date which suggests that the podcast episodes and videos continue to contribute to the understanding of OER. The ABOER funding was a one-time opportunity that proved significant for advancing OER within the province of Alberta and beyond.

10.4 Awareness

These media are a learning resource in two graduate level courses at Athabasca University and have been used for faculty training by BC Campus. The meta-tagging has supported the discoverability of these media, and periodic analytics of website visitation indicate that Canadian, American, and global viewers are accessing and using the videos, podcasts, and conference archives. Increasing the awareness of OER by educators involves all levels of education, including faculty who instruct pre-service and in-service teachers. Awareness building continues to be necessary in part because of the complexities involved with the engaging with the full potential of OER. Helping educators understand that OER are more than free resources but involve a set of practices, and pedagogical change is part of the depth and breadth that the media project initiated. As with all awareness building efforts, saturation is desired, but it takes continual efforts to achieve this level of recognition.

At a small scale, these media have increased the awareness of OER. The links are easy to mention in presentations and emails and they have been shared through Twitter. They continue to form the key elements and address the need that I had originally identified. Yet, it appears from my interactions with graduate students, colleagues, and educators in general that OER awareness building still requires more time and more people.

10.5 5Rs

The 5Rs (Wiley 2014) of OER delve into the possibilities that inhere open licensing. These 5Rs include the following rights:

1. Retain – the right to make, own, and control copies of the content (e.g. download, duplicate, store, and manage)
2. Reuse – the right to use the content in a wide range of ways (e.g. in a class, in a study group, on a website, in a video)
3. Revise – the right to adapt, adjust, modify, or alter the content itself (e.g. translate the content into another language)
4. Remix – the right to combine the original or revised content with other material to create something new (e.g. incorporate the content into a mashup) and
5. Redistribute – the right to share copies of the original content, your revisions, or your remixes with others (e.g. give a copy of the content to a friend) (BC Campus n.d., para 2).

This set of rights hold many possibilities that support the affordances of OER. These possibilities – ranging from localizing content, reusing and repurposing, adapting to multiple contexts, extracting an educational asset, language translating, editing, customizing, aggregating, differentiating instruction, and redistributing – catalyse what educators have done in the past. However, with the possibilities of information and communication technologies, these actions do not just live within that one educator's classroom. Additionally, with these changes comes the opportunity to invoke and support learners' participation in these actions.

Moving to second and third iterations of an OER will flag a more mature understanding of the affordances of OER. However, creating OER overshadows the iterative and agile embeddedness of the affordances provided by OER. From my interactions with graduate students (i.e. in-service teachers), educators currently prefer to create and share OER more than they engage in reuse, revision, or remix.

10.6 OER Benefits

As research within higher education contexts has shown, there are numerous benefits to understanding and using OER (McGreal 2019). OER researchers have found that OER, when effectively used and supported, generates cost savings for students; enhances efficiencies, speed, and immediacy in updating resources; nurtures sharing, the use of multiple channels, and formats of delivery; encourages crowdsourcing content contributions; blurs lines between formal and informal learning; and may enable online collaborations and partnerships (McGreal 2019). These benefits occur simultaneously and evolve due to the collected efforts of OER advocates. However, thinking of OER in causal terms undermines the potency of the multiple and layered networks that inhere the set of practices and choices that accompany openness in education.

10.7 Pedagogical Thinking

The three videos of the *Multiply K-12 OER* media project refer to Hegarty's eight attributes of open pedagogy model (2015). This model builds upon Conole's (2013) five principles of openness:

- Sharing information through collaboration
- Communications about pedagogy – networked or offline
- Informal or formal collectivity to assemble resources
- Critique for the enhancement of scholarly critical thinking
- Unanticipated and creative responses

  Conole as cited by Hegarty (2015)

In combination with these principles are the three needs of using OER and open architectures; an organizational vision that supports openness in education; and using and advocating for OER as a means to attain the larger vision of openness (Hegarty 2015). These dimensions rest at a high, abstract level, what Weller (2010) called *big OER* which contrasts to the micro goals, Weller's *little OER*, that may be met by the intended educator audience of the *Multiply K-12 OER* media project, individually or in small clusters. Changes in education occur slowly and OER efforts at both the institutional level and at the interface of current students and their teachers may meet in the middle, when big OER meets up with the little.

With the possibility of such a merger, the eight attributes of open pedagogy (Hegarty 2015) reflect the context of higher education, but in many aspects, they apply equally to the education of younger students. Unlocking Hegarty's model, ahead of all the other attributes, is the key of *participatory technologies*. This participation is often perceived by educators as the participation of other educators and in the initial movement towards open pedagogy this holds true. However, as the awareness and confidence grow in open pedagogy, the participation moves to include contributions by learners.

Because all learning involves other people, human relational elements hold a place within teaching and learning. This relational understanding of pedagogy undergirds teachers' orientations in primary and secondary schooling. Consequently, the second attribute of *people, openness, and trust* enhance open pedagogical choices just as a constrictive and controlling authoritative stance limits an individual and collective educational ethos. Because participatory technologies unlock technological affordances, the element of trust catalyses OER possibilities. Trust comes in many forms – trust in the quality of the OER, trust in the educational technology itself, trust in the processes of the 5Rs, and most importantly, trust in the people involved. And because of the ephemeral nature of trust, thoughtful revisiting of its role in open pedagogy is appropriate and wise.

Within the model of open pedagogy, a synergy is at play, and the next four attributes interrelate and directly reinforce one another. Attribute three, *innovation and creativity*, emerges through the alchemical processes that unfold through the *sharing of ideas and resources* (attribute four), through a *connected community* (attribute five), and ought to include *learner-generated resources* (attribute six) (Hegarty 2015). In the media project, novice OER educators discussed how they include activities and direct student learning through these four attributes. These same educators are not novices with open pedagogical practices, as teaching younger students has moved many of these educators towards aspects of open pedagogy such as design- based learning, technology-enhanced learning as well as individualizing and differentiating their instruction. What these educators and my graduate students have revealed is the insight that *they did not realize such practices were anything more than contemporary teaching practice*; and they now have a collective noun to name their teaching – *open pedagogy*.

Attribute seven, *reflective practice*, initially appears orientated towards the educator (Hegarty 2015). Stepping back, reflecting upon a lesson, a unit plan, or an entire year of teaching marks how a professional works (Schön 1994). Reflective practice incorporates a set of skills and attributes, of which metacognition holds a significant role. Metacognition, thinking back upon one's thinking, is directly taught within Canadian primary and secondary schools, and for some provinces such as British Columbia, the new curriculum discretely highlights meta-cognitive skills and are taught to young children to late teens. Metacognition, self-reflection, and critical thinking skills enmesh and highlight contemporary skills that are part of the curriculum. Reflective practice, as Hegarty's seventh attribute demonstrates, marks the shift that is occurring within teaching and learning and curriculum – all three elements working to buttress the model of open pedagogy.

The final attribute, *peer review* (Hegarty 2015), at first glance, is similar to attribute seven – in that one might interpret peer review as belonging to educators and not students. Initially, this interpretation may be the most common, as open pedagogical practices unfold over time and peer review within higher education marks a standard and criticality that is highly valued. Within open pedagogy, peer review also relates to aspects of trust – in that providing collegial peer review, both the reviewer and the one receiving the feedback have a respectful orientation towards each other, the process, and the OER artefact as well. Being open to the comments of others requires trust and vulnerability for peer review and when done badly can be detrimental to relationships and the necessity of sharing. This is not to say that peer review within a cycle of open pedagogical peer review should not hold any negative or critical comments, but the adage, *it is not what you do but how you do it*, applies. The expectations that teachers would have of their students regarding trusting relationships, metacognition, self-reflection, and critical thinking holds true as peers. Ideally, once peer review has been established successfully, involving students as part of a peer review process would be possible.

10.8 Looking Forward

The initial purposes for this media project still hold constant because awareness building of OER and open pedagogy will continue for some time yet. Outside forces, such as a recent Canadian case of litigation, have heightened many educators' awareness of copyright laws, and this awareness has been from the classroom level to government authorities and deans of faculties of Education. As part of the litigation, 300 randomly selected Canadian schools have been required from their teachers to provide 7 years of lesson plans to demonstrate how they have used copyrighted materials. The lawsuit is between Access Copyright (an organization that collects royalties for authors and publishers) and the provincial Education departments, excepting British Columbia and Quebec (Von Stackelberg 2019). This lawsuit has placed a focus on educators and their understanding and use of educational materials – which may encourage a desire and need to look towards understanding copyright more actively, including open licensed resources. The results of this lawsuit may bring OER awareness and invigoration to all levels of educators due to financial and legal pressures.

However, awareness is only the first step. Understanding the 5Rs and the affordances of participatory technologies must be reshaped to fit the legal and moral confines of teaching children and young adults. Some educators suggest that OER for students in primary and secondary schooling requires semi-open spaces, a walled garden to ensure ethical and safe learning spaces for both students and their teachers. Achieving the benefits of OER and open pedagogy will require a thoughtful and integrated approach, embedding Conole's five principles of openness into the complex structures, procedures, policies, and laws that encompass this level of education. Without such thoughtfulness, OER could become a Pandora box of entangled connections, missing their potentials, and thereby drive educators back to educational publishers and reinforce the monopsony of the print era, but with a digital twist. Fundamentally, it is not a case of either/or but rather how these two approaches to educational resources may coexist for the benefit of educators, and most importantly for the students.

Within Canada, future practice and policy changes for OER at the primary and secondary level requires a substantial set of amendments to provincial educational directives and decisions. Informed changes require considerable understanding of what OER and open pedagogy entail by those who create the direction of public education; such knowledge is what is needed for *big OER* to truly take hold. Without the support of those who create educational laws, policies, and guidelines, the benefits of OER may reach a stalemate as they migrate beyond the classroom level. Despite the benefits of OER, this form of educational change has not come quickly even as part of *little OER*. Further professional learning is necessary and the void that the media project aimed to fill still requires further and ongoing attention, for all levels and types of educators.

10.9 Conclusion

Technology-enabled learning has arrived, and educators are currently in the position to embrace an open pedagogy in a thoughtful and purposeful manner. Degrees of openness, for various students, at various times, for assorted reasons -these decisions need to be part of the self-reflective processes of an open pedagogy. As Havemann (2020) notes "openness is better understood a matter of degree or quality, rather than one half of a binary" (p. 3). By understanding OER, educators may move onto using such resources, best proceeding in small increments, small degrees of openness, or as phrased by David Wiley (2014), "*iterating toward openness* [with] *pragmatism before zeal"* (para 1).

Wiley suggests that openness in education can spawn a zeal, an enthusiasm that requires tempering by pragmatics. And perhaps we need to pause and recognize that being an OER champion, an advocate for openness in education can fizzle quickly when the hard realities of intransigence meet up with the Pandora box of entangled connections of OER and open pedagogies. To iterate requires repeated efforts, albeit slightly different each time, and the scope and scale of an OER iteration may often be small and individual. Over time, however, the repeated iterations of moving towards openness may reveal that changes have occurred and that pragmatism before zeal has shifted primary and secondary education towards openness. It is in this vein, that the *Multiply K-12 OER* media project is one small example of this iterating towards openness.

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Websites

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Appendix A

Multiply K-12 Open Educational Resources

A series of podcasts and videos to support teacher awareness, use, and support of OER.

Table of Contents

Podcasts

1. **Welcome: The Project Context** A brief overview of this ABOER project describes the overall goals of OER awareness, use, and advocacy for Canadian K-12 educators. Experiences and insights gained during the creation of the podcasts and videos are briefly shared by the project creators. (Contributors: Connie Blomgren, Verena Roberts)

Part One
OER in K-12 Learning: An Overview

2. **A History of OER**
   This look at the history of OER describes the evolution from learning objects, through the development of new and open licensing frameworks, and finally towards new forms of resources such as open textbooks and other innovations, as presented by several key participants in this movement. (Contributors: TJ Bliss, Randy Labonte, Rory McGreal, David Porter, Sarah Weston)
3. **The Current Landscape of OER** This podcast presents the varied and changing landscape of K-12 OER through a series of descriptions of practical and research initiatives in OER from around the world and introduces some of the OER champions helping to drive these initiatives forward. (Contributors: TJ Bliss, Beatriz de los Arcos, Michael Canuel, Bill Fitzgerald, Randy Labonte, Rory McGreal, David Porter, Sarah Weston)

4. **Benefits of OER for K-12 Learning** This podcast considers the benefits of open educational resources and what they can contribute to the work of professional educators and to the learning of students, including cost savings, the improvement and increased flexibility and relevance of content, and the enhancement of the teacher's role as content expert and professional. (Contributors: Beatriz De Los Arcos, Royce Kimmons, Rory McGreal, Sarah Weston)
5. **Acceptance of OER in K-12 Education** This look at the acceptance of OER in K-12 education explores some of the challenges that come with moving from a copyright-restricted educational environment to open resources, and how some organizations and their leaders have overcome barriers such as resistance to change and quality concerns. (Contributors: TJ Bliss, Bill Fitzgerald, Royce Kimmons, Randy LaBonte, Rory McGreal, David Porter, Sarah Weston)

Part Two
OER and Pedagogy in K-12 Learning

6. **Learning with OER** This podcast explores the impact of K-12 OER on learners, including how it can create previously inconceivable learning opportunities, support differentiated learning, and encourage the student voice. (Contributors: TJ Bliss, Michael Canuel, Bill Fitzgerald, Rory McGreal, Sarah Weston)
7. **Teaching with OER** This podcast considers the developing awareness and use of K-12 OER by classroom teachers, the changes to teaching and learning that an open teaching practice creates, and the ongoing need for OER professional development for educators. Contributors: TJ Bliss, Michael Canuel, Beatriz de los Arcos, Bill Fitzgerald, Royce Kimmons, Randy LaBonte, Sarah Weston)
8. **Openness and the Open Mindset in Learning** This deeper look at the concepts and principles of openness and the open mindset asks what it means to be truly open, to practise as an open educator, and to foster a mindset of openness in ourselves and in our classrooms, with reflections by a number of key researchers and practitioners in open education. (Contributors: Michael Canuel, Beatriz de los Arcos, Royce Kimmons, Randy LaBonte, Rory McGreal, David Porter)
9. **The Eight Attributes of Open Pedagogy** This podcast explores the attributes of open pedagogy through an in-depth interview with Bronwyn Hagerty, describing her model involving eight overlapping dimensions ranging from technology, to personal and community characteristics, to reflective practice. (Contributor: Bronwyn Hegarty)
10. **The Open Pedagogy Model** The examination of Bronwyn Hagerty's model of open pedagogy continues with a closer look at the OEPosphere, discussion of the principles of openness inspiring her model, and the reception to it by the open educational resource community. (Contributor: Bronwyn Hegarty)

Part Three
OER Policy and Copyright in K-12 Education

11. **Creating Policy for OER in Canada** This podcast discusses the creation of supportive policies for open educational resources in Canada and the Canadian

provinces, asking how the structure of the education system affects the options around the use of OER, and what changes might be required to take full advantage of OER to transform teaching and learning. (Contributors: Randy LaBonte, Rory McGreal, David Porter)

12. **Copyright and User Rights: A Definition of Terms** This overview of copyright law and fair dealing or user rights in Canada features an in-depth interview with Jim Swanson, a lawyer specializing in intellectual property and copyright, defining the key terms and principles to guide teachers in their use of open educational resources and avoid potential copyright infringement. (Contributor: Jim Swanson)
13. **K-12 Contexts with Copyright and Fair Dealing** This set of podcasts continues the in-depth interview with intellectual property and copyright lawyer Jim Swanson through a series of scenarios describing familiar situations teachers may face when introducing open educational resources into their classrooms. (Contributor: Jim Swanson)

    A. **K-12 Scenarios with Copyright and Fair Dealing** (Contributor: Jim Swanson)
    B. **Supplementary Scenario: Digital Copies and Copyright** (Contributor: Jim Swanson)
    C. **Supplementary Scenario: Learning Management Systems and Copyright** (Contributor: Jim Swanson)
    D. **Supplementary Scenario: Course Sharing and Copyright** (Contributor: Jim Swanson)
    E. **Supplementary Scenario: Content Creation and Copyright** (Contributor: Jim Swanson)

Appendix B

Videos

Open Pedagogy I: Attributes of Open Community Through a series of interviews and direct examples, a panel of teachers from Alberta describe their use of open educational resources to create their own open communities of learners, following the first four attributes of Bronwyn Hagerty's model of open pedagogy: participatory technology; people, openness, and trust; innovation and creativity, and the connected community.

Open Pedagogy II: Attributes of Open Practice The panel of teachers from Alberta continue their descriptions of, and recommendations for, the effective use of open educational resources in the classroom through the remaining four attributes of Bronwyn Hagerty's open pedagogy model: sharing ideas and resources; learner-generated content; reflective practice; and peer review.

Albertan Perspectives on OER in K-12 Learning This workshop video introduces a group of teachers from Alberta as they explore open educational resources, present their own experiences with OER in their classrooms, and offer suggestions for their effective use to enhance learning.

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Chapter 11
Beyond Mindfulness Mondays: The Potential of Open Education to Support Whole School Wellbeing – *A Case Study from Australia*

Anna Dabrowski

11.1 Introduction

When looking to the teaching profession in Australia, it may come as a surprise that the quality of Australian education is increasingly marred by attrition rates among early career and established teachers. But perhaps even more concerningly, the rates of violence and threats of harm directed towards educators continue to rise (Riley 2018). Accordingly, as more principals, teachers, and support staff face anxiety and ongoing stress due to the emotional demands of the role, there are now a number of initiatives that seek to augment the wellbeing of educators in Australian schools. However, many of these initiatives target individuals, and encouraging mindfulness alone is not enough to counter the challenges of burnout and ongoing stress. Thus, in response to the ongoing need for meaningful wellbeing support programs for educators in Australia, the *Wellbeing Toolkit*, developed by professional development provider NESLI, aims to facilitate the development and maintenance of both wellbeing and relationships in schools through an open education model. Indeed, the *Wellbeing Toolkit* is one of the only initiatives currently available in Australia to support wellbeing at a whole school level, yet despite more than 7000 educators participating in the program, little is known about the effects of the program upon graduates. As the *Toolkit* expands beyond Australia and New Zealand into China, the USA, and Finland, this chapter seeks to understand the possibilities of open education to address and augment the wellbeing of educators in K-12 schools.

Parts of this chapter formed a research report evaluating the impact of the NESLI Wellbeing Toolkit. Selected extracts have been reproduced with permission.

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11.2 Wellbeing in K-12 Schools

Research indicates that the teaching profession is one of the most stressful professions within which to work (see De Nobile 2017; Gonzalez et al. 2008; Griva and Joekes 2003; Naghieh et al. 2015). Wellbeing is not ignored within the education profession and there have been a number of initiatives that have sought to address and support wellbeing of staff and students; however, the teaching profession faces unique challenges and pressures from students, families, and a changing system, and educators often rate their wellbeing as lower than other comparative social professions (Grenville-Cleave and Boniwell 2012). It is therefore not surprising that attrition rates of professionals in schools are an ongoing issue. Indeed, if "teachers do not experience a sense of wellbeing in their work and they feel they lack competence, this may result in high attrition rates … and high stress levels" (Pillay et al. 2005, p. 25).

Stress and overall wellbeing are often cited as key reasons educators choose to stay or leave the profession. Day and Qing (2009) argue that stress from the role is exacerbated by the fact that "many teachers work in environments that are hostile to their wellbeing" (p. 16). A positive sense of wellbeing contributes to work satisfaction and productivity, and most importantly, demonstrates a positive influence on the levels of student wellbeing and academic achievement (see Spilt et al. 2011). Research indicates that improving school performance might have a positive impact on teacher wellbeing, but improving teacher wellbeing also improves student outcomes (Briner and Dewberry 2007). However, more research is needed to understand the impact of educator wellbeing on student outcomes, as to date, "interpersonal relationships between teachers and students have been largely ignored as a factor of significance to teacher wellbeing" (p.458). Indeed, although educators face enormous challenges in their roles, the difficulty of the profession can be eased through positive relationships with students, parents, colleagues and leadership, which in turn, can have an affirmative influence on educators' sense of wellbeing. The relationships within schools, and the resultant reciprocity created through bonds, norms, and trust, are discussed in the next section on social capital.

11.3 Social Capital and Its Impact on Wellbeing

Although educators face enormous challenges in their roles, the difficulty of the profession can be eased through positive relationships with students, parents, colleagues and leadership, which in turn, can have an affirmative influence on educators' sense of wellbeing. The relationships within schools, and the resultant reciprocity created through bonds, norms, and trust are often missing in a profession struggling with overload and burnout. There are a number of different definitions of social capital (see Baum 2000; Coleman 1988; OECD 2001 (as cited in Temple 2002); Putnam 2000) but all definitions share a common understanding of social capital as the process of participation in communities, and the creation and impact of networks, norms, trust, and reciprocity.

Coleman (1988) in particular considers the importance of social structure in both supporting or sanctioning our obligations and expectations, and our behaviours. Thus, "shared social norms such as reciprocity together with trust enable those in a community to more easily communicate, cooperate and to make sense of common experiences" (ABS 2002, p. 5–6). Today, social capital is used widely to measure and understand the health of an organisation. Social capital, in the form of participation in networks, groups, and organisations, can have a positive impact on the overall wellbeing of communities (Bush and Baum 2001), as well as individual health. Social connectedness, and the bonds we share with others, are associated with increased life expectancy (Baum 2000), improved social and emotional functioning, as well as overall happiness. Social capital is essential to the wellbeing of both individuals and communities as a whole, allowing us to fully participate in society.

As Riley's (2016) research on principal health and wellbeing indicates, improving relationships has the best chance of positive, sustainable change for the education system. Humans crave company, we live in communities, and our individual health and wellbeing is intricately tied to the health of our communities and our interactions with others. Moreover, many norms and behaviours are established by the community, and the ties we have to others in our community influence our choices. However, our social connections, and the social capital we possess is falling (see Putnam 2000), and this is an area of concern, as the communities we belong to offer us resources that we might not be able to access on our own (Christakis and Fowler 2009).

11.4 Current Approaches to Building Wellbeing and Social Capital in Australian Schools

In recent years, a range of different approaches have been employed in schools in order to support student and staff wellbeing. Positive psychology approaches (see Kern et al. 2014; Seligman et al. 2009) are widely used within the education sector, as is mindfulness training (Bishop et al. 2004), and sociopsychological wellbeing interventions at early career (Le Cornu 2009) and established teacher levels (Soini et al. 2010) aim to foster resilience and autonomy. Evidence from these studies suggests that reflection on professional practice, coaching in learning communities, and emotional regulation development can support educator wellbeing levels. However, as Naghieh et al. (2015) argue, most of these initiatives target individual wellbeing alone, and fail to consider the need for organisational level wellbeing interventions that recognise the cultural complexities of schools and educational organisations. Access to community resources, and participation in a shared experience, are crucial for educators, as lower social capital levels can impact on relationships, reduce job satisfaction, and lead to attrition and job stress. Building bonds within schools, and supporting staff to be part of a community is essential to facilitate individual and community wellbeing, and may also improve attrition rates in the profession.

Thus, in order to enhance the wellbeing of staff in schools, "professional learning efforts targeting teacher wellbeing should aim for more than simply reducing stress and burnout—they should also strive to cultivate positive patterns of thinking and feeling" (Cook et al. 2017, p. 15). Cook et al. make a key point, and it is this rationale that has led to the design of the wellbeing toolkit. However, there should also be a recognition of the need to support relationships within the broader school context, rather than focusing on individual-level change, and the need to facilitate enhanced social capital in organisational cultures. As Berryhill et al. (2009) conclude, "making changes in individuals when the system is part of the problem leaves basic structures intact and is unlikely to affect the problem … policymakers should consider making changes for teachers rather than in teachers" (p. 9).

11.5 Open Education and the "Wellbeing Toolkit"

In order to move away from reactive and highly individual solutions to the wellbeing issue-driven internally in schools, some open education providers have responded with the provision of open education initiatives not linked to teaching standards or professional learning outcomes. In this context, NESLI, a small educational provider based in Australia has developed the *Wellbeing Toolkit*, a self-paced, internally managed program that is suitable for all staff in schools, including non-teaching school employees. The toolkit is informed by research into Australian Principal Health and Wellbeing (see Riley 2016, 2018), which looks at the impact of social capital on wellbeing in schools. Riley's research shows that when social capital increases within an organisation everyone improves together, and the Wellbeing Toolkit is therefore designed around the maxim of improving relationships and wellbeing at a whole school level. The *Wellbeing Toolkit* has three key aims:

1. To enable individuals to take a proactive approach to their own wellbeing and develop the mindsets and behaviours which will support them through challenging times.
2. To enable professional communities to work collaboratively to more effectively support one another's health and wellbeing.
3. To contribute to improved student outcomes through enhancing staff engagement, wellbeing and connectivity.

In addition, broader goals for the future implementation of the toolkit include addressing issues of low morale and impact of excessive workload among educators in order to empathise with and proactively recognise the challenges faced by teachers; build trust within the profession; and ultimately, reduce the attrition rate among the profession by providing increased support for educators. The toolkit consists of five key modules, which are designed to be rolled out in participating schools. Prior to commencing the program, schools nominate one or more senior staff members to act as Toolkit Leaders, who facilitate five peer learning sessions focusing on health and wellbeing, addressing and overcoming personal and professional challenges, and building resilience.

11.6 Evaluating the Effects of the Wellbeing Toolkit

The research presented in the next part of this paper was informed by a number of key questions around both the process of implementation, and the impact of the wellbeing toolkit on participants: *(1) What is the program trying to achieve? (2) How effectively is the program designed and delivered?* And finally, *(3) Is the program successful?*

In order to gather meaningful data, a mixed-methods evaluation approach was applied. In order to capture pre- and post-program survey data, the Wellbeing Toolkit uses two validated instruments to measure wellbeing and social capital. The Warwick-Edinburgh Mental Wellbeing Scale is a well-established 14-item scale across five response categories covering feeling and functional aspects of wellbeing. The second measure is the Short Measure of Workplace Social Capital Survey, which consists of an eight-item survey developed to measure workplace social capital. Both of these impact surveys were completed by participants pre- and post-program. All survey submissions were anonymous and only school-wide data are used to provide an overview of school-level wellbeing and social capital. A total of 9417 total survey responses were analysed at the pre-survey phase across 232 schools around Australia, including state, Catholic, and Independent schools. Of this total, 4786 respondents were recorded against the wellbeing measures, and 4631 respondents on the social capital measures. Rural, remote, provincial, and urban schools are all represented in this sample, as are mainstream and special education facilities at the K-12 level.

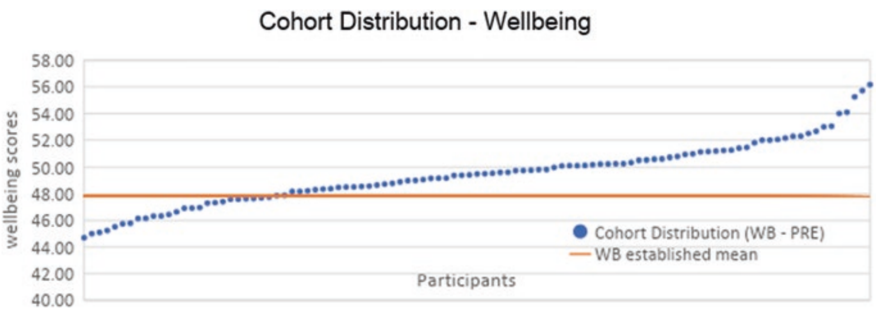
The Warwick-Edinburgh Mental Wellbeing Scale and the Short Measure of Workplace Social Capital Survey were repeated at the end of the program, with responses collected from school leaders, teachers, and teaching assistants. At the conclusion of the *Wellbeing Toolkit*, program participants were invited (but not required) to complete these surveys, accounting for a lower response rate. A total of 3452 total survey responses were collected at the post-survey phase across 141 schools around Australia, including state, Catholic, and Independent schools. Rural, remote, provincial and urban schools are all represented in this sample, as are mainstream and special education facilities at the K-12 level.

11.7 Case Studies

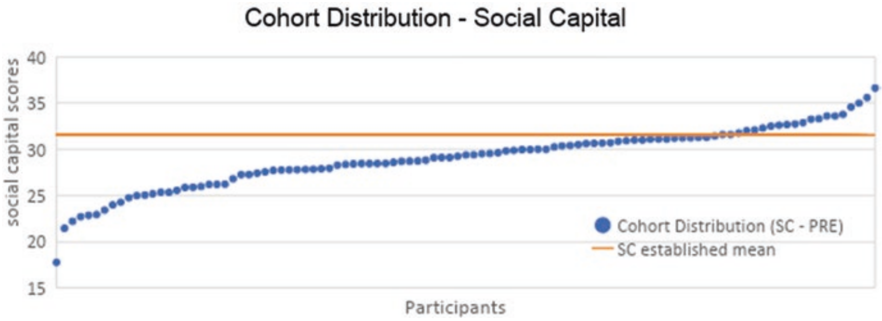
In addition to the survey data collected pre- and post-program, eight in-depth case studies were also conducted in schools and educational organisations around Australia. The case studies provide rich, descriptive insights into the experiences of program participants and offer suggestions for enhancing the toolkit in the future. Finally, more than 500 existing data sources were also analysed, derived from a combination of anonymous module activities, program tasks, journal entries, and open-ended comments. In a theory-based approach, qualitative data provide vital context. These sources provide rich, descriptive insights into the wellbeing and social capital levels of participants, offering a source of triangulation for the pre- and post-program data.

11.8 Findings

The responses of Wellbeing Toolkit participants provide a robust sample for research into the impact the toolkit has had on individuals across Australia. These data are based on the largest sample (to date) of educators who have undertaken a wellbeing intervention program in Australia. The analysis of data reveals that overall, the mean wellbeing levels of sampled Australian educators (m = 49.49) are higher than the average mean levels of wellbeing in comparable contexts, with many participating schools reporting wellbeing levels well above the average. The distribution of wellbeing levels across program participants is provided below.



However, the cohort distribution of social capital levels (m = 29.80) is considerably more varied than the overall wellbeing levels reported, as the figure below demonstrates. Social capital scores are also substantially lower with 73% of the cohorts represented below the average mean of 31.54.



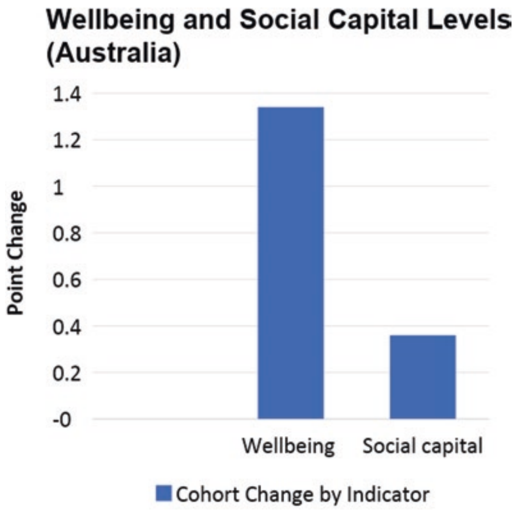
11.9 Australian Educators: Anxious, Lonely, and Overworked

Although the data collected from the wellbeing pre-program survey portrays Australian educators with wellbeing levels higher than the established mean, the qualitative data gathered from the program provides a different perspective. Supporting the distribution findings that demonstrate lower levels of social capital levels across cohorts, qualitative program data provides meaningful insights into the lives of participants. Participants cited three key challenges as impacting on their individual wellbeing and their ability to build/foster social capital in their lives: *anxiety, workload*, and *loneliness*. These three themes were all seen as impediments not only to health, but to participation in relationships, and the application of adaptive coping strategies needed in the teaching profession. Toolkit participants noted that their anxiety, workloads, and loneliness had an impact on their classrooms, their families, and their student, but also on their sense of self- a finding which was particularly evident among female toolkit participants.

> Work life taking over everything… (Teacher)
>
> I feel my family are playing up because their mum isn't home enough… I feel sad (Teacher)
>
> I have lost sight of my gifts, passion and purpose. I am so used to saying I'm a mum and a teacher and I have lost who I am as a person (Teacher)

These insights provide a portrait of a profession in duress, of a profession that is often left without support. Yet there is also inherent loneliness in the comments, a loss of belonging, and a lack of participation in the private or public worlds that educators exist in. The comments made by *Toolkit* participants come as little surprise, indeed, Australian educators have some of the highest workloads in the OECD, and also express some of the greatest rates of burnout (see Pillay et al. 2005).

11.10 Increases in Wellbeing and Social Capital Levels



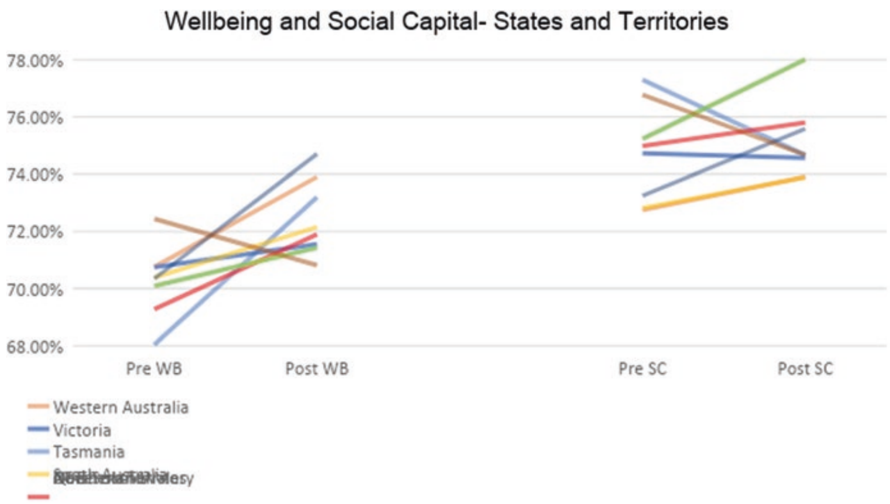
In light of the challenges discussed in the previous section, it is worthwhile considering the emerging impacts the toolkit is having upon participants in Australian schools and educational facilities.

As the graph demonstrates, the social and wellbeing capital levels of Australian participants saw modest but statistically significant increases.

It is impossible to be precise about how much change in WEMWBS is considered 'meaningful', yet best estimates based on research into the instrument range from 3 to 8 WEMWBS points difference between 'before' and 'after' time points. Although there is an increase in wellbeing levels upon completion of the toolkit, it is important to note that in Australia, collective wellbeing mean scores began at a higher starting point, and social capital at a lower starting point.

11.11 Location Differences

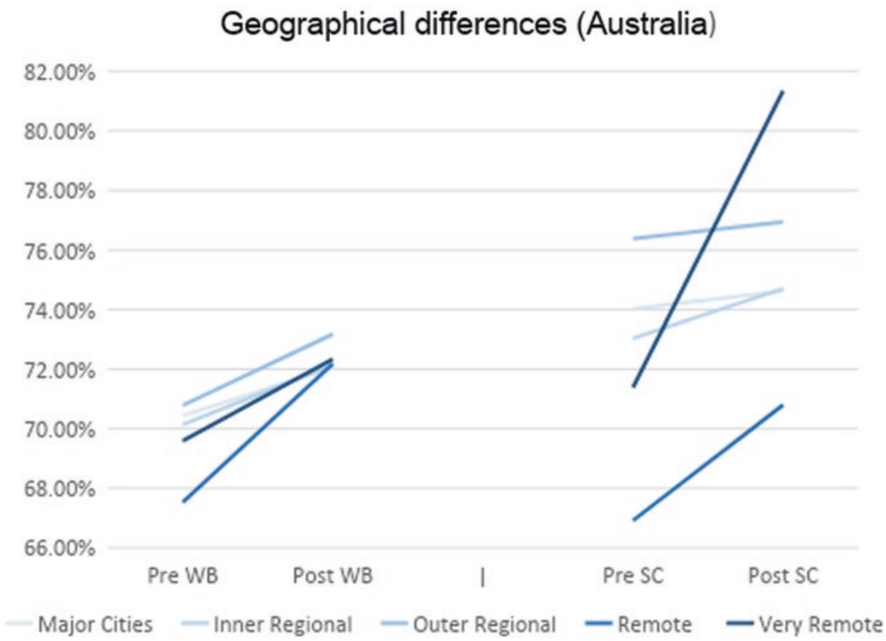
The graph below presents the overall pre- and post-wellbeing and social capital scores by state and territory. Australia is a diverse country yet one that operates under a federalised model, in which states and territories have a level of autonomy. For this reason, an analysis of the differences across Australia provides an opportunity to understand what works, and where.



Overall, Queensland, the Northern Territory, South Australia, and Western Australian have shown the highest gains on wellbeing and social capital indicators. The Australian Capital Territory decreased in terms of their overall wellbeing and social capital scores.

11.12 Geographical Differences

The graph below presents the overall pre- and post-wellbeing and social capital scores by location.



Overall, as the graph above illustrates, remote schools and very remote were most positively impacted by participation in the toolkit, across both reported well-being and social capital levels.

11.13 Increasing Confidence

While the quantitative data presented above demonstrates modest increases in the wellbeing and social capital levels of participants in different spaces across Australia, qualitative program data acknowledge a wide range of significant positive impacts on toolkit graduates. In this context, participants acknowledged increased feelings of self-confidence and self-esteem, citing participation in the modules and networking opportunities as enhancing their personal and professional lives:

> [The toolkit] has also helped shaped the way I think about my personal life, increasing my sense of self confidence and self-esteem (Teacher)
>
> Opened up many opportunities for networking and creativity which boosted my self-esteem (Educational Assistant)

11.14 Self-Regulation and Self-Awareness

Participants also described heightened self-awareness and self-regulation as key outcomes of participating in the toolkit. Across leadership levels, participants reported an increased capacity for dealing with their emotions, and for participating in, and responding to, conflict with staff and parents:

> I am better able to release my temper and my angry response, and more able to treat others with compassion and respect (Educational Assistant)
>
> I feel much more comfortable when I am talking with staff and community members who are angry and require careful handling to ensure a positive outcome to the talks (Assistant Principal)
>
> The Wellbeing Toolkit has been extremely beneficial in transforming my thinking process (Teacher)

11.15 Peer Relationships

Peer relationships were also seen as to have been affected by participation in the toolkit. Relating to the construct of horizontal social capital, toolkit participants reported improvements to their peer relationships within teams, and of providing a mechanism for communication and exploration:

> My team members have commented on the fact that they feel supported and appreciate my support. (Teacher)

> As a team, we got to know each other better through these sessions and will definitely look after each other better (Assistant Principal)
>
> Definitely a positive impact within the team...opens opportunities for brainstorming and supporting one another... opens up communication where it has otherwise broken down (Teacher)

Putnam (2000) examines the importance of community organisations in the development and maintenance of social capital. Putnam describes social capital as the interactions, relationships, and connections among individuals, which result in reciprocity, trust, and cooperation. However, drawing upon these notions of social capital, it appears that as *Wellbeing* toolkit graduates increase in stress levels, there is hesitation to include others within the established spaces and there appears to be a resultant decline in the bridges and bonds between staff. This results in the loneliness and anxiety expressed by program participants.

11.16 Personal Relationships

In addition to enhanced peer relationships, participants also noted shifts in their personal relationships. Current and past toolkit participants described increases to their work–life balance through a reignition of their career passion. Participants saw benefits not only for their interactions with partners, but also in supporting their role as a parent:

> I am better able to be a mum who engages peacefully and provides solutions (Teacher)
>
> My children and partner have started to notice the difference in my interactions with them (Teacher)
>
> My home life feels good because of this... I talk to my family about passion, purpose and gifts, my children will hopefully act and then think and look forward with higher expectations (Teacher)

11.17 Reduced Stress and Anxiety

The qualitative data analysed in this research also saw participants report a range of positive impacts on their mental health, primarily the reduction of feelings of overwhelm and anxiety, but also supportive strategies to reduce the anxiety of individuals within the organisation.

> Feeling much less overwhelmed, mental health and wellbeing is far better. (Teaching assistant)
>
> [The toolkit tasks] reduced my anxiety. Made things more manageable. (Teacher)
>
> This has given me some great examples to assist staff to relax (Principal).

11.18 Job Satisfaction and Relationships with Students

The final theme that emerged from the qualitative analysis is related to job satisfaction. The same participants who had described feelings of burnout, overload, and mental and physical exhaustion reported increasing levels of happiness, community, belonging, and encouragingly, satisfaction in their interactions with students:

> This has been a life-changing professional development module for me that has come at just the right moment (Teacher)
>
> The course has allowed me to find a safe space to explore some questions about what in my practice was inhibiting me from having wellbeing and how I could make changes by just committing to a few specific attitudes or attitude goals. (Teacher)
>
> I feel better as I feel more in control of my life (Teacher)
>
> I feel more relaxed and [am] enjoying the different experiences with students (Teacher)

11.19 Possibilities: The Potential of Open Education to Support Educator Wellbeing

Acknowledging the relationships within and across school communities can have a significant impact on the resilience of educators, and the subsequent opportunities afforded to Australian students. Yet supporting the wellbeing of educators is a complex issue, and here, the adoption of a whole school open education approach, such as the *Wellbeing Toolkit*, has great potential to impact positively upon the teaching profession. The data presented in this chapter note some small but positive shifts in the wellbeing and social capital levels of toolkit participants. This is particularly evident in remote and rural schools: schools that are often starved of resources, and when considering comparative OECD data, fall far short of Australian norms.

Qualitative data garnered from case studies, module data, journal entries, and reflections on participation offer a particularly positive view on the emerging impacts of the *Wellbeing Toolkit*. Although Australian participants report higher wellbeing levels than established norms in similar contexts, participants continued to make gains as a result of participation in the program. Toolkit participants also identified a range of reported impacts as a result of participation in the toolkit, including improved relationships and physical health, decreased anxiety, and higher levels of happiness. Across leadership levels within schools and educational facilities, program graduates reported gains in their personal and professional lives, and as research indicates, decreasing anxiety and enhanced feelings of esteem and happiness may have a flow on effect to the classroom – in both the diversity and meaning of interactions between staff and students, and the subsequent quality of education that students receive.

The data presented in this paper demonstrate that there is a desire for connectedness and belonging within Australian schools, but the importance of developing social capital through relationships (Putnam 2000) falls to the wayside beneath a looming awareness of the need to meet the increasing standards imposed on the teaching profession. In turn, the wellbeing and interactions of staff suffer, manifesting at times in stress and anxiety, and more overtly, in attrition among educators. Such stress among educators is only likely to continue to increase, as outcomes-based education, teaching standards, and an increasingly inequitable system see teachers 'blamed when students fail to learn' (see Dinham 2013). Yet focusing on relationships and allowing participants time and support to fully engage with each other in schools is key, as allowing educators a chance to engage in the formation of wellbeing communities will only enhance wellbeing, and continue to raise levels of social capital.

When considering the potential of open education to support wellbeing, it is crucial to consider the realities of the teaching profession, including workload, and often, a lack of support from school and system leaders for wellbeing measures that are sidelined in the pursuit of academic outcomes. The teaching profession, and the associated demands from parent and student communities are unlikely to shift soon. But with ongoing support and recognition for the need for structural wellbeing initiatives, open education wellbeing initiatives can facilitate renewed support for the education profession. There are many programs currently available that aim to build teacher wellbeing in schools, but the point of difference for open education initiatives such as the *Wellbeing Toolkit* offers a renewed focus on supporting the relationships of participants as a mechanism to enhance collective efficacy, wellbeing, and social capital.

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Chapter 12 Mobile-Assisted Language Learning in a Secondary School in Iran: Discrepancy Between the Stakeholders' Needs and the Status Quo

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12.1 Introduction

Technology application in educational environments has facilitated the quality of learning and teaching activities and has provided a wide range of practicable affordances for educational institutions and organizations (Bernard et al. 2014; Brown 2009; Gibson 2001; Jacobsen et al. 2002; Khurshid et al. 2016; Ramadhani et al. 2019; Selwyn 2013). Similarly, computer-assisted language learning (CALL) has opened up new horizons for a plethora of teachers and educational practitioners (Dina and Ciornei 2013; Felix 2005; Garrett 2009; Golonka et al. 2014; Grgurović et al. 2013; Li and Ni 2011; Merç 2015; Nguyen 2008; Timucin 2006). In the same way, several research studies pertaining to technology use and language teaching have been undertaken in the field of English as a Foreign Language (EFL). These research strands are particularly diverse in nature and typically explore the following: teachers and learners' attitudes toward technology use (e.g., Aydin 2014; Ayres 2002; Baz 2016; Sagarra and Zapata 2008; Stepp-Greany 2002; Vandewaetere and Desmet 2009; Zhao 2013), the use of technology to teach language skills (e.g., Askildson 2011; Ihmeideh 2009; Xianwei et al. 2016; Yoshii 2013; Yun 2011), and the effectiveness of various technologies for EFL teaching (e.g., Asoodar et al. 2016; Ko 2012; Reinhardt 2019; Wang and Vásquez 2012).

As a staunch and an efficacious approach to learning, mobile learning has introduced new and effective types of learning which can be implemented inside and outside the classroom in a flexible manner (Demouy et al. 2016; Duman et al. 2015; Pedro et al. 2018; Thüs et al. 2013). The remarkable affordances of mobile learning

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implementation in educational contexts include creating interactive learning environments, motivating students to learn, reducing learning and teaching costs, providing easy access, and providing quality feedback (Dashtestani 2016; Kukulska-Hulme and Shield 2008). Despite these affordances, mobile learning has posed some challenges, including causing distraction in the classroom and placing enormous demands on teachers (Ally 2013; Pedro et al. 2018; Stockwell 2007).

The language learning context is not an exception in that different mobile devices have been used for boosting the quality of language learning and teaching (Bitter and Meylani 2016; Doan 2018; García Botero et al. 2019; Huang et al. 2016; Jung 2015; Kim 2013; Kruk 2017; Lai and Zheng 2018; Schenker and Kraemer 2017; Wrigglesworth and Harvor 2018). The innovative use of mobile devices and the implementation of mobile learning in language teaching and learning contexts is known as mobile-assisted language learning (MALL). One important obstacle to implementing MALL in EFL courses is the negative attitudes of learners toward learning through mobile devices since mobile devices are commonly believed to be used for non-educational purposes (Ally 2013). Therefore, it appears to be crucial to analyze the perspectives of educational stakeholders, including EFL stakeholders, on the challenges and affordances of implementing MALL (Dashtestani 2016).

For example, White and Mills (2014) explored Japanese EFL learners' attitudes toward MALL and the use of smartphones for language learning. They reported that the majority of EFL students used smartphones for personal and non-educational use. Reluctance to utilize smartphones for EFL learning and educational purposes was also reported. Similar findings were reported by Dashtestani (2016) who analyzed Iranian EFL learners' attitudes toward mobile learning. Despite the positive views of EFL learners of MALL, they did not use mobile devices for learning purposes. Also, mobile learning was strictly restricted due to several pragmatic and attitudinal challenges and limitations. It was also argued that some Iranian teachers did not allow learners to use mobile devices in the class. Saidouni and Bahloul (2016) conducted a study on teachers and students' attitudes toward MALL and suggested both the teachers and students were positive about the learning and teaching potentials and benefits of MALL for EFL courses. As a result, more training, time allocation, and technological infrastructures were recommended regarding MALL implementation. Hsu (2013) carried out a cross-national study of students' attitudes toward MALL. Even though there existed significant differences among the attitudes of students from different nations and cultural backgrounds, the participants held a positive attitude toward MALL and constructivism in EFL learning.

As for the effect of MALL on students' vocabulary learning and attitudes, Agca and Özdemir (2013) reported that the implementation of MALL increased students' level of vocabulary knowledge and that the EFL students elicited a positive response to MALL implementation in the EFL class. Kondo et al. (2012) also argued that the implementation of MALL fostered Japanese university students' learning without the intervention of the teacher, that is, self-study, with regard to the time spent on the tasks, students' satisfaction, and self-measured achievement. Caldwell (2018) undertook a study on Japanese EFL students' attitudes toward MALL and information and communications technology (ICT). It was reported that the students were interested in MALL activities due to benefits such as convenience and flexible learning as well as student-centered learning. Distraction was a drawback of MALL based on the perspectives of the students. Concerning the Chinese EFL context, Zou and Yan (2014) analyzed Chinese EFL students' attitudes toward MALL and its impact on their language learning. The results provided evidence that MALL motivated EFL learners to learn English and the fact that a wide range of MALL activities were used by students. It was also revealed that the region in which the students live could have a strong impact on their attitudes toward MALL and its efficacy for language learning.

As the previous research on MALL and attitudes suggests, many university students are interested in the use of mobile devices for learning EFL. While the participants of the majority of the studies on attitudes toward MALL were adult learners of EFL in university and academic contexts, very limited attention and research has been directed toward adolescent students at secondary schools. Moreover, most studies have considered only students as the participants while other stakeholders, including teachers and parents, were not considered. To address the dearth of research in this important area, this study investigated MALL attitudes from the perspectives of Iranian secondary school students, teachers, and parents. The perceived challenges and affordances of MALL practices both inside and outside of the classroom environs were explored in this study. Furthermore, a comparison between student and parental attitudes toward MALL is presented in this chapter. The following research questions were formulated for this study:

1. What are Iranian secondary school students, teachers, and parents' attitudes toward using mobile devices for learning EFL? Is there any significant difference between students and parents' attitudes?
2. What are Iranian secondary school students, teachers, and parents' perspectives on limitations of using mobile devices for learning EFL? Is there any significant difference between students and parents' perspectives?
3. What are Iranian secondary school students, teachers, and parents' perspectives on factors which have the strongest effect on students' use of mobile devices for learning EFL?
4. What mobile learning activities are practiced by Iranian secondary school students both within and outside the classroom environment?

12.2 Method

12.2.1 Participants

Three sample groups participated in this study. The first group of participants comprised 211 junior high school students attending 7 separate classes of a public school in Tehran, the capital city of Iran. These junior high school students, aged between 12 and 15 years, completed the questionnaire designed for the purpose of this study.

Table 12.1 Profile of students participating in the study

Gender	Female 211 (100%)
Average age	13.5 years old
Province	Tehran
Grade	Junior high school
Average years of experience of learning EFL at school	2 years
Questionnaire participants	210 students

Table 12.2 Profile of parents participating in the study

Average age	38 years old
Average years of experience of using technology	4 years

Table 12.3 Profile of EFL teachers participating in the study

Gender	Female 5(100%)
Average age	32.3 years old
Average years of teaching experience	7.95 years
Average years of experience of using technology in EFL classes	5 years

In addition, 30 students participated in the interviews (Table 12.1). The other sample group included 20 parents of the students participating in the study with an average age of 38. This cohort completed the questionnaires with regard to their children's use of mobile devices (Table 12.2). In addition, five EFL teachers participated in the interviews of this study. These participants were junior high school teachers of EFL based in Tehran (Table 12.3).

12.2.2 Instruments

12.2.2.1 Questionnaires

Three versions of a questionnaire were designed and employed in this study. The questionnaire designed for the students included five distinctive sections. The first section of the students' questionnaire explored students' attitudes toward mobile learning (9 items). The second section of the questionnaire examined students' perceptions of the limitations of mobile learning (10 items). The third section investigated students' motivation for mobile learning (5 items). The next section explored students' use of mobile devices for different purposes (4 items) as well as learning different skills at home and at school through mobile devices (12 items). The last two sections of the questionnaire explored students' familiarity with different components of mobile learning (6 items) as well as students' ability to work with mobile devices for EFL purposes (4 items). The parents' questionnaire included the first 3 sections of the students' questionnaire and the items regarding students' use of mobile devices for different purposes with a total of 29 items.

The levels of Kaiser-Meyer-Oklin (KMO) measure of sampling adequacy for each section were estimated (section 1 = 0.80; section 2 = 0.66; section 3 = 0.53; section 4 = 0.53; section 5 = 0.88). In addition, a Bartlett's test of sphericity (0.00) was also used. The results of these tests showed that the exploratory mode of factor analysis was possible to be applied. Factor loadings higher than 0.30 were considered as suitable. An acceptable loading pattern for the questionnaire was achieved in this study. The Cronbach's alpha coefficient (0.793) also depicted an acceptable level of consistency for the items of the questionnaire. In addition, the items of the questionnaire were checked and assessed by five professors of TEFL.

12.2.2.2 Interviews

In order to support or reject the findings of the questionnaires, the interview questions were developed. In addition, in order to compare the points mentioned by the cohorts, similar questions were developed for the two samples of participants, including students and teachers. The questions of the interviews included:

1. What do you think about the use of mobile devices for learning EFL?
2. What are the benefits of using mobile devices in learning EFL?
3. What are the possible limitations and challenges of using mobile devices in learning EFL?
4. In your opinion, who/what has the greatest impact on students' use of mobile devices for learning EFL?
5. What do you think are the most important purposes of using mobile devices for EFL students?
6. What kind of mobile learning activities are used in your EFL classes?
7. What do you think of students' ability in working with mobile devices for learning EFL?

Students were also asked about different mobile activities they used for learning EFL at home.

12.2.2.3 Observations

Non-participant observations were another phase of the study which carried out in order to explore students' actual use of mobile devices in the classroom. To do so, 10 sessions of seven EFL classes from one public school in Tehran were observed. Each EFL class was observed at least once. During the classroom observation sessions, notes were taken by the researchers to assist the data collection. Each classroom session lasted an hour and a half.

12.2.3 Data Analysis

SPSS version 22 was utilized to analyze the data. Descriptive and inferential statistics were considered as part of our data analysis. The results of the questionnaires were presented in the form of mean and standard deviation for each item. The differences among the perspectives of the teachers and students were identified using the non-parametric Mann–Whitney U test. The construct validity of the questionnaire was insured through applying exploratory factor analysis and the reliability was checked through the Cronbach's alpha test. The interviews were presented based on the analysis of both common and frequent themes. The results of our observations were subsequently transcribed and reported.

12.3 Results

12.3.1 Students, Teachers, and Parents' Attitudes Toward Mobile Learning

As Table 12.4 shows, both students and their parents agreed that mobile learning had benefits for students' learning. The results show that there were no significant differences between the perspectives of parents and students. The majority of students pointed out ubiquitous learning ($M = 4.31$, SD = 0.73), ease of use ($M = 4.69$, SD = 0.63), interesting learning ($M = 4.18$, SD = 0.89), and the low cost of mobile devices ($M = 4.03$, SD = 1.07) as the benefits of learning via mobile devices. Their parents perceived interesting learning ($M = 4.35$, SD = 0.67), attractive learning ($M = 4.30$, SD = 0.80), facilitation of learning ($M = 4.05$, SD = 1.05), ease of use ($M = 4.60$, SD = 0.75), and ubiquitous learning ($M = 4.30$, 0.57) as the most beneficial features of MALL.

In the interviews, both students and teachers mentioned similar themes as the main and important benefits of MALL. These perceived benefits include portability of mobile devices, possibility of using mobile devices anytime and anywhere, attractiveness of using mobile devices for learning and finally the affordability of such devices (Tables 12.5 and 12.6).

Table 12.4 Questionnaire findings on students and parents' attitudes toward mobile learning

Items	Participants	*M*	SD	Mann–Whitney U	*p*
Using mobile devices for learning is interesting	Students	4.18	0.89	1953.5	0.556
	Parents	4.35	0.67		
Using mobile devices makes learning more attractive	Students	4.08	0.96	1877.5	0.385
	Parents	4.30	0.80		
Mobile learning helps students store new information in their long-term memory	Students	3.41	1.12	1817.5	0.285
	Parents	3.15	1.04		
Mobile devices can be used anytime	Students	3.76	1.17	2063.5	0.865
	Parents	3.85	1.04		
Learning via mobile applications facilitates learning	Students	3.88	1.06	1934	0.517
	Parents	4.05	1.05		
Using mobile devices for learning is easy	Students	4.69	0.63	2034.5	0.719
	Parents	4.60	0.75		
Mobile devices can be used anywhere	Students	4.31	0.73	1993	0.649
	Parents	4.30	0.57		
Buying mobile devices is less costly than buying books and pens	Students	4.03	1.07	2047	0.813
	Parents	3.95	1.19		
Using mobile devices makes learners interested in learning	Students	3.67	1.15	1995.5	0.673
	Parents	3.80	1.15		
Learning via mobile devices motivates learners	Students	3.84	1.12	1953.5	0.565
	Parents	3.95	1.14		

Note: Likert scales: 1. strongly disagree; 2. disagree; 3. undecided; 4. agree; 5. strongly agree

Table 12.5 Interview findings on students' attitudes toward mobile learning

Theme 1: Portability of mobile devices
*Theme 2:*Having access to a wide range of information
Theme 3: Possibility of using mobile devices anywhere
Theme 4: Ease of working with mobile devices
Theme 5: Attractiveness of using mobile devices
Theme 6: Possibility of using mobile devices anytime
Theme 7: Developing motivation for language learning
Theme 8: Cost-effectiveness
Theme 9: Possibility of using electronic dictionaries on mobile devices
Theme 10: Possibility of language learning in less time

Table 12.6 Interview findings on teachers' attitudes toward mobile learning

Theme 1: Possibility of language learning in less time
Theme 2: Portability of mobile devices
Theme 3: Possibility of using mobile devices anytime
Theme 4: Cost-effectiveness
Theme 5: Possibility of using mobile devices anywhere
Theme 6: Possibility of using different applications
Theme 7: Attractiveness of using mobile devices
Theme 8: Internet connectivity

Table 12.7 Questionnaire findings on students and parents' perceptions of limitations of mobile learning

Items	Participants	*M*	SD	Mann–Whitney U	*p*
There is no access to mobile devices at school	Students	4.87	0.59	2082.5	0.816
	Parents	4.95	0.22		
Learning via mobile devices causes distraction	Students	3.21	1.30	1769.5	0.218
	Parents	3.60	1.14		
Suitable mobile devices are too expensive to be purchased	Students	2.88	1.49	2080	0.914
	Parents	2.85	1.56		
Students lack digital literacy to use mobile devices for educational purposes effectively	Students	1.81	1.23	1841.5	0.271
	Parents	1.50	1.05		
Teachers do not allow students to use mobile devices for learning	Students	2.52	1.77	1965	0.578
	Parents	2.25	1.61		
Parents do not allow students to use mobile devices for learning	Students	1.76	1.37	1911	0.381
	Parents	2.15	1.66		
School regulations limit students' learning via mobile devices	Students	4.75	0.86	2006.5	0.501
	Parents	4.55	1.23		
The lack of training for using mobile devices properly	Students	2.72	1.52	2068.5	0.881
	Parents	2.60	1.35		
The lack of awareness about EFL Mobile-based apps	Students	1.73	1.12	1616	**0.040***
	Parents	1.20	0.52		
The lack of access to mobile applications for learning EFL	Students	1.73	1.16	1901.5	0.385
	Parents	1.50	0.94		

*0.05

Note: Likert scales: 1. strongly disagree; 2. disagree; 3. undecided; 4. agree; 5. strongly agree

Table 12.8 Interview findings on students' perceptions of limitations of mobile learning

Theme 1: Lack of access to mobile devices in EFL classes
Theme 2: Lack of knowledge for choosing authentic apps for language learning
Theme 3: Lack of knowledge about language learning apps
Theme 4: Using mobile devices may cause distraction

Table 12.9 Interview results on teachers' perceptions of limitations of mobile learning

Theme 1: Parents' disapproval of students' use of mobile devices at home
Theme 2: Lack of knowledge about language learning apps
Theme 3: Lack of adequate training about mobile learning
Theme 4: Lack of access to the Internet for using online apps
Theme 5: Lack of access to mobile devices in EFL classes
Theme 6: Using mobile devices may cause distraction

12.3.2 Students, Teachers, and Parents' Perceptions of Limitations of Mobile Learning

Tables 12.7 and 12.8 illustrate clearly how the implementation of mobile learning in Iran is strictly challenging. It became clear from our examination of the data that all the participants, that is, students, parents, and EFL teachers, agreed on the obstacles associated with using mobile devices. The students reported a number of challenges regarding their use of mobile devices for learning EFL. These barriers included school policies which forbade the use of devices (M = 4.87, SD = 0.59), school rules and regulations (M = 4.75, SD = 0.86), and distraction caused by mobile devices (M = 3.21, SD = 1.30). It is interesting to note that the issue of mobile devices being banned in school also emerged as a salient theme during the observation sessions.

In terms of parental feedback, it became apparent that this group believed that students had an acceptable level of awareness when using EFL software tools for mobile learning (M = 1.20, SD = 0.52) and that they had fair access to mobile applications for learning EFL (M = 1.73, SD = 1.16).

There were both differences and consensus in the perspectives of the teachers, the students, and their parents. The teachers believed that parents' disapproval of students' use of mobile devices at home, the lack of knowledge of choosing authentic apps for language learning, and the lack of access to the Internet for using online apps were the main concerns and obstacles of MALL implementation (Table 12.9).

Table 12.10 Questionnaire findings of students and parents' views of factors affecting students' motivation for mobile learning

Items	Participants	*M*	SD	Mann–Whitney U	*p*
English teacher	Students	4.74	0.71	2053	0.759
	Parents	4.85	0.36		
Family	Students	3.01	1.19	1949.5	0.560
	Parents	2.95	0.60		
Friends	Students	3.29	1.28	657	**0.000***
	Parents	1.65	0.67		
School	Students	1.93	1.17	630	**0.000***
	Parents	3.50	0.51		
Media	Students	2.33	1.30	1191	**0.001***
	Parents	3.15	0.67		

*0.05

Note: Likert scales: 1. strongly disagree; 2. disagree; 3. undecided; 4. agree; 5. strongly agree

Table 12.11 Interview findings on students' views on factors affecting students' motivation for mobile learning

Theme 1: EFL Teachers

Table 12.12 Interview findings on teachers' views on factors affecting students' motivation for mobile learning

Theme 1: EFL teachers
Theme 2: Students' friends
Theme 3: Social media

12.3.3 Factors Affecting Students' Motivation for Mobile Learning

Table 12.10 indicates that the EFL students and their parents mentioned the role of the EFL teacher as a key element with regard to encouraging students to use their devices for educational purposes (M = 4.74, SD = 0.71 and M = 4.85, SD = 0.36). Other factors mentioned such as the family, friends, the school, and the media had no significant impression on students' motivation for using mobile devices for learning EFL.

As demonstrated in Tables 12.11 and 12.12, there is a significant difference between the perspectives of the teachers and students about the role of influential factors on students' motivation for mobile learning. In the interview, the students considered their EFL teacher as the most important factor in this environment. On

Table 12.13 Questionnaire findings on students' use of mobile devices

Items	Participants	*M*	SD	Mann–Whitney U	*p*
Use of mobile devices for academic purposes	Students	3.69	1.12	1880	0.397
	Parents	3.95	0.88		
Use of mobile devices for EFL purposes	Students	3.82	0.98	1612	0.065
	Parents	4.25	0.71		
Use of mobile devices for fun	Students	4.04	1.17	2093.5	0.950
	Parents	4.15	0.98		
Use of mobile devices for non-academic purposes	Students	3.64	1.20	1983.5	0.641
	Parents	3.85	0.98		

Note: Likert scales: 1. never; 2. rarely; 3. sometimes; 4. frequently; 5. always

Table 12.14 Interview findings on teachers' perspectives of students' use of mobile devices

Theme 1: Use of mobile devices for fun
Theme 2: Use of mobile devices for non-educational purposes
Theme 3: Use of mobile devices for chatting with their friends

Table 12.15 Interview findings on students' perspectives of their use of mobile devices

Theme 1: Use of mobile devices for fun
Theme 2: Use of mobile devices for texting our friends
Theme 3: Use of mobile devices for listening to music
Theme 4: Use of mobile devices for using social media
Theme 5: Use of mobile devices for playing games

the contrary, the EFL teachers believed that other factors such as friends and the social media may affect students' motivation for mobile learning.

12.3.4 Students' Mobile Learning Practices

As the questionnaire results depict, the majority of students and their parents mentioned that the students use mobile devices for recreational activities (M = 4.04, SD = 1.17 and M = 4.15, SD = 0.98). In the interviews, the teachers stated that the students use their mobile devices for non-educational purposes such as chatting with their friends and having fun. The EFL teachers tried to motivate students to exploit their mobile devices for academic purposes, especially for EFL learning (Tables 12.13 and 12.14).

Table 12.16 Questionnaire findings on students' use of mobile devices for learning different skills at home

Items	Participants	*M*	SD
Reading	Students	3.45	1.10
Learning vocabulary	Students	4.30	0.95
Grammar	Students	3.45	1.30
Conversation	Students	3.66	1.13
Listening	Students	3.67	1.20
Pronunciation	Students	4.22	1.14

Note: Likert scales: 1. never; 2. rarely; 3. sometimes; 4. frequently; 5. always

Table 12.17 Questionnaire findings on students' use of mobile devices for learning different skills at school

Items	Participants	*M*	SD
Reading	Students	1.00	0.00
Learning vocabulary	Students	1.01	0.20
Grammar	Students	1.00	0.00
Conversation	Students	1.00	0.00
Listening	Students	1.00	0.00
Pronunciation	Students	1.00	0.00

Note: Likert scales: 1. never; 2. rarely; 3. sometimes; 4. frequently; 5. always

In the interviews, most of the students said that they use mobile devices for fun. The majority of EFL students mentioned texting their friends, playing games, listening to music, and using social media as the main uses of their mobile devices (Table 12.15).

As Table 12.16 demonstrates and the interview results show, the students affirmed that the major use of mobile devices for learning different skills at home is related to learning new vocabulary items (M = 4.30, SD = 1.10), and pronunciation (M = 4.22, SD = 1.14).

Based on the results of Table 12.17, it is obvious that there is no use of mobile devices for learning different skills at Iranian schools. The majority of EFL students confirmed that they were not allowed to use mobile devices at school. In the interviews, the teachers mentioned the school rules and regulations as the main limitation of using mobile devices in their EFL classes. In fact, the EFL teachers and students were not able to have any mobile learning activities in their classes.

A total of 10 sessions of observations showed that there is no use of mobile devices and no MALL activities in EFL classes. EFL classrooms were not well-equipped with digital devices. The results indicated that most teachers tried to raise the students' awareness of MALL activities and encourage their students with regard to using mobile devices for EFL learning at home. Some teachers assigned their students activities which could be done through the use of mobile devices such as looking up the definitions of new words and pronunciation of new words.

Table 12.18 Questionnaire findings on students' familiarity with different components of mobile learning

Items	Participants	*M*	SD
Mobile applications for EFL learning	Students	4.10	1.09
Common mobile applications for EFL learning	Students	3.64	1.09
Valid websites for downloading applications for EFL learning	Students	3.64	1.13
Proper use of mobile applications for EFL learning	Students	4.04	1.14
Free applications for EFL learning	Students	3.94	1.20
Paid applications for EFL learning	Students	2.96	1.16
Search engines for downloading applications for EFL learning	Students	4.12	1.12

Note: Likert scales: 1. strongly disagree; 2. disagree; 3. undecided; 4. agree; 5. strongly agree

Table 12.19 Questionnaire findings on students' ability to work with mobile devices for EFL purposes

Items	Participants	*M*	SD
Installing mobile applications for EFL learning	Students	4.34	1.05
Proper use of EFL applications	Students	4.09	1.03
Recognizing valid applications for EFL learning	Students	3.57	1.29

Note: Likert scales: 1. strongly disagree; 2. disagree; 3. undecided; 4. agree; 5. strongly agree

As shown in Tables 12.18 and 12.19, the students claimed that they were familiar with mobile applications for EFL learning ($M = 4.10$, SD = 1.09) and search engines for downloading applications for EFL learning ($M = 4.12$, SD = 1.12). They were also able to install these applications ($M = 4.34$, SD = 1.05).

In the interviews, the EFL teachers claimed that the students were familiar with different applications for EFL learning, but they were not able to recognize valid and credible applications. The EFL teachers believed that both teachers and students needed some training courses with regard to using MALL applications and enabling them to learn about the different functions available on these applications. The majority of students mentioned that while they were able to search for and install MALL applications, their main concern was related to how to select and use a suitable mobile application for learning EFL.

12.4 Discussion and Conclusion

This study was an attempt to uncover the current challenges and affordances of MALL implementation in the context of Iran. All the participants, that is, EFL teachers, students, and parents, held positive attitudes toward the implementation of MALL in Iranian secondary schools. This positive perspective and view can pave the way for a more effective and influential MALL integration in Iranian EFL courses. Previous research has also confirmed the results of this study regarding the positive attitudes of teachers and students toward MALL (Agca and Özdemir 2013; Dashtestani 2016; Kondo et al. 2012; Saidouni and Bahloul 2016; White and Mills 2014). Interestingly, there was not a significant difference between students and parents' attitudes toward the benefits of MALL for EFL learning. This issue might imply that parents have a clear and realistic judgment about technology, including mobile devices, and are aware of the potential merits of MALL for their children's educational practices and language learning. Without proper attitudinal infrastructures, it is not feasible to incorporate new technologies into EFL instruction. It appears that in the context of Iran, these attitudinal and perceptual requirements are existent based on the findings of this study. Educational planners and decision makers of the Ministry of Education in Iran should pay specific attention to these positive perspectives of Iranian EFL stakeholders of secondary school on mobile learning and provide the required facilities and human resources in order to facilitate the inclusion of effective mobile learning activities in EFL instruction. What seems obvious is the fact that positive attitudes cannot guarantee the successful integration of mobile learning into EFL instruction and much more follow-up and tangible measures should be taken and considered by the Ministry of Education and EFL curriculum developers in this regard.

Despite the positive responses of the participants of the study, implementing mobile learning seems to be restricted and impeded due to several significant perceived barriers and hindering elements. The study did not show any significant differences regarding mobile learning obstacles from the perspectives of students and parents. Access to mobile devices at school was a serious limitation which was pointed out both by the parents, students, and teachers. This is a pragmatic restriction which is a basic and required condition for mobile learning implementation in EFL courses. The other perceived obstacle was the lack of training for the proper use of mobile devices for learning or teaching EFL. This shortcoming was also reported in previous studies (Dashtestani 2016; Saidouni and Bahloul 2016). Both teachers and students need to be trained and prepared for the proper and effective use of mobile devices for their educational purposes. Moreover, MALL-based training should be continuous and based on the needs of EFL students. Thus, more needs analysis studies on MALL-based skills and competences for teachers and students should be carried out in the future. These needs-based studies will guide us through stipulating a training plan for Iranian EFL teachers and students throughout the nation. Similar studies and measures can also be taken into account in other contexts and countries in order to promote the efficacy of mobile learning activities. One interesting finding was that some teachers believed that students' parents might be negative about their children's use of mobile devices in the EFL class. However, the findings regarding the attitude of parents revealed that the parents were positive about the use of mobile devices in the EFL class. It should be striven to make teachers aware of the opinions and decisions of parents in school education. To achieve this aim, periodic discussion sessions and meetings on topics pertaining to technology use in EFL instruction between parents and teachers are suggested.

The results also showed that mobile devices are not used in the EFL class for learning different language skills and sub-skills and that the students reported that they did use mobile devices for language learning outside the classroom. In many Iranian schools, mobile devices are not allowed to be used or brought into the classroom since many teachers and educational supervisors believe that students' use of mobile devices makes class management difficult and can be a potential cause of student distraction. It is advisable that school course planners and those who are in charge take some measures to change this negative perspective toward using and having mobile devices in the classroom.

The results of the interviews with teachers and students revealed that the students use mobile devices for recreational and non-educational purposes. This finding was also reported in previous research (Dashtestani 2016). This issue might be pertinent to students' lack of knowledge and training on how to employ mobile devices for educational and learning purposes or their lack of awareness about educational applications of technology in EFL learning. EFL course planners and decision makers should consider awareness-raining plans and measures about using mobile devices for learning EFL. Allowing and encouraging students to use mobile devices in the classroom can have a tremendous effect on students' acceptance of mobile devices as learning tools.

Considering the efficacy of the use of mobile devices in EFL contexts, more large-scale and needs-based studies are required. The role of socio-economic factors and the digital divide are important issues which need more investigation and research. Furthermore, more needs analysis studies are essential in order to identify useful technologies and mobile learning activities for secondary school students.

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Chapter 13
The Current Status of Open Education Practices in Japan

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13.1 The Spread of OERs and MOOCs in Asia

Open educational resources (OERs) and massive open online courses (MOOCs) are being developed and utilized in higher education institutions across the globe. Activities related to OERs in tertiary institutions (22.4%) are higher than those in primary or secondary institutions (UNESCO 2012a, b). As of July 2019, a total of 1071 organizations in 248 countries participate in the development and dissemination of OERs (OER World Map 2019). As of 2018, over 900 universities offered MOOCs, 101 million individuals enrolled, and over 11,000 courses were created (Class Central 2019). A survey of faculty members of higher education institutions in the United States found that one-third were aware of OERs, wished to take advantage of them, and recognized them as equal in quality to traditional educational resources (Allen and Seaman 2014). Many higher education institutions utilize OERs daily as learning materials in the form of open textbooks or supplemental materials. Moreover, the movement of open educational practice—called "Open Pedagogy"—is evolving (EDUCAUSE 2018). Introducing learner-centered design to use OERs for not only substituting publishers' textbooks but also "interacting"

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with open-licensed textbooks in the learning process by editing or revising them has become widespread among educational practitioners (DeRosa and Robison 2017). The OER movement has expanded on a global scale, led by international organizations like UNESCO, which has organized the World OER Congress twice and promotes the creation and introduction of OERs in K-12 and post-secondary education based on its declaration (UNESCO 2012a) and recommendation (UNESCO 2018).

Several Asian countries have made national efforts to disseminate MOOCs in the region. Thailand and Korea have established national platforms (TMOOC and KMOOC). Chinese universities have established a MOOC platform to collaborate with IT companies (XuetangX and CNMOOC). The Taiwan government provides funding support for universities to develop and offer MOOCs on the national platform (Taiwan MOOC). Similar to the practices in the United States and Europe, international collaboration is emerging in Asia too. The Japanese, Korean, and Thai MOOC platforms include a memorandum for cooperation (JMOOC 2017). A survey of geographic data shows that the mean rate of certificate attainment in Asian countries is relatively higher than in other regions (Nesterko et al. 2013).

In Japan, the primary means for institutions to participate in OERs are through OpenCourseWare (OCW) initiatives. In 2004, OCW activity was introduced and recommended by MIT. In response, several universities have started the preparation of lectures published in compliance with the OCW. On May 13, 2005, Osaka University, Kyoto University, Keio University, Tokyo Institute of Technology, and the University of Tokyo formally announced the start of OCW activities in Japan. The predecessor of this consortium “Japan OpenCourseWare Liaison Committee” was also launched simultaneously. In December 2005, Kyushu University and Nagoya University participated in the Liaison Committee at Hokkaido University. The Open University of Japan (formerly National Institute of Media Education) also participated in the Liaison Committee as a co-member. On April 20, 2006, the Japan OpenCourseWare Consortium (JOCW) was established. It was founded to promote the activities of open courseware and support exchange of information among members. Also, the JOCW joined the Open Education Consortium, an international consortium to promote open education globally. As of May 2019, 14 universities and seven companies and non-profit organizations are participating in JOCW. Sixteen universities and colleges in Japan opened OCW websites and published learning materials on them in 2017 (JOCW 2017). Although several universities currently promote the creation and use of OERs to improve education on campus (Center for OpenEd HU 2017), overall, OER creation and use are still not widely established in Japan.

On the other hand, there is active use and development of MOOCs in the country. Six universities participate in edX or Coursera and have provided open access to their courses. In 2014, the JMOOC—an organization that promotes and disseminates the integration of MOOCs—was established. JMOOC is a council based on business–academia collaboration, which aims to spread the MOOC through industry–academia cooperation. As of May 2019, 36 universities and 46 companies and nonprofit organizations were participating in JMOOC. Some universities use MOOC for pre-university improvement education (Docomo Gacco and Osaka

Sangyo University 2016). Lifelong learning is widely considered to be an essential opportunity for broadening the horizons of every generation, and MOOCs are seen as stimuli for the promotion of lifelong learning through online education.

13.2 Characteristics of the University System and Lifelong Learning in Japan

Compared to other regions, Japan's open education activities are not overwhelming. One of the reasons for this is the lack of support from governments and foundations. The Japanese government has no OER policy or funding for open education activities. Foundational support for higher education institutions is limited, except for university-owned foundations, which focus on support for their host universities. Most open education activities in Japan are self-funded. Thus, it makes it difficult for higher education institutions to robustly and sustainably accelerate the open education movement. For the past decade, however, national and local government funding has decreased owing to their financial difficulties, which makes it difficult for institutions to invest in budgets for open education. Another reason is that, compared to those in other regions, Japanese institutions have not had to be as sensitive to students' financial difficulties, particularly with regard to learning materials. Textbook costs, for example, are relatively moderate compared to those in the United States. These circumstances contribute to the low levels of awareness and introduction of OERs in Japan.

In terms of lifelong learning, a survey shows that strong demand exists in Japan. A survey of the Cabinet Office reveals that 58.4% of the respondents have experienced lifelong learning while 82.3% said that they would like to use lifelong learning opportunities for hobbies and work (Cabinet Office 2018). Nevertheless, compared to other countries, Japan has considerably fewer admissions to university than 25 years ago because of the decline in the young population. Additionally, the difficulty of securing time, lack of educational programs that cater to mature students, and tuition fees are barriers to lifelong learning (MEXT 2016). In Japan, opportunities for lifelong learning through online education such as MOOCs are adequate; indeed, Japanese universities sense the potential of MOOCs as a means of expanding opportunities for lifelong learning.

13.3 Survey of the Awareness, Offering, and Adoption of OERs and MOOCs in Japan

Concerning the current status of open education practices in Japan, the Ministry of Education conducted a national survey of the use of OERs and MOOCs in higher education institutions in 2013 (Kyoto University 2014). This survey aimed to ascertain the use of OERs and MOOCs at an institutional level. The university system in Japan consists of four-year institutions, two-year institutions, and technical colleges. Two- and four-year institutions are funded by the national government, private institutions, or local governments. The national or local governments fund most technical colleges. These higher institutions were the subjects of the survey. This research revealed that the degree of recognition and assignment of future value was relatively high in national universities and technical colleges, but relatively low in public universities and two-year institutions. In 2013, only one university offered MOOCs, and only 15 organizations were planning or considering offering them within the next 3 years. With regard to the use of MOOCs, approximately 80% of four-year institutions and technical colleges and 90% of two-year institutions answered "not offering" or "unknown." The main reasons that institutions provided MOOCs were to increase the number of educational choices, expand options for providing diverse education, improve the learning environment for students, contribute to society, and distribute educational and public information for high school students. Based on this survey, the Academic eXchange for Information Environment and Strategy (AXIES) conducted a similar survey (AXIES 2015). In this chapter, the findings of the latest survey will be revealed to demonstrate the current status of open education practices in Japan.

13.4 Awareness of OERs

The responses concerning the degree of awareness of OERs are shown in Fig. 13.1. By type of institution, the positive responses of "very aware" and "aware" were 56.8% for four-year institutions, 39% for two-year institutions, and 55.3% for technical colleges. The highest level of negative responses ("not aware") was for two-year institutions (13%). Regarding the source of funding, the positive responses of "very aware," "aware," and "somewhat aware" were 86.8% for public institutions supported by the national government, 41.3% for public institutions supported by local governments, and 53.8% for private institutions.

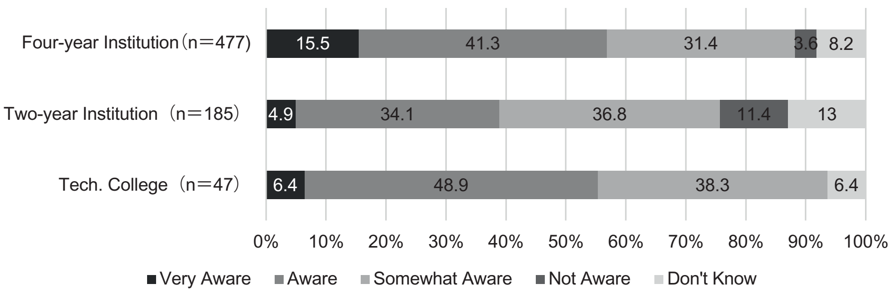

Fig. 13.1 Awareness of OERs in higher education institutions

13.5 Offering and Adopting OERs

Responses by institutions concerning offering and adopting OER and MOOCs are shown in Fig. 13.2. The rates of OER offerings and adoption were low for all organizations. Four-year institutions registered the highest rate of offering OERs (13.8%), followed by technical colleges (8.5%) and two-year institutions (2.2%). Four-year institutions registered the highest rate of adopting OERs (5.9%). Regarding planned offerings and adoptions in the future, Technical colleges were most likely to plan to adopt OERs in the future (46.8%). By source of funding, national public universities led in adopting OERs (26.2%) as well as planning to adopt OERs in the future (45.9%). These figures are similar to those by the previous survey.

13.6 Offering and Adopting MOOCs

Regarding institutions currently offering MOOCs, four-year institutions accounted for 5.2%, and two-year institutions 0.5%. Regarding planned offerings, 14.7% of four-year institutions, 6% of two-year institutions, and 17.1% of technical colleges were planning to offer MOOCs in the future. These figures represent a small decrease since the previous survey.

13.7 Purpose of Offering OERs and MOOCs

Responses by institutions concerning the purposes of offering and adopting these programs are shown in Fig. 13.3. Regarding the purpose of offering OERs, "Improve learning environment for students," "Wider selection of educational opportunities,"

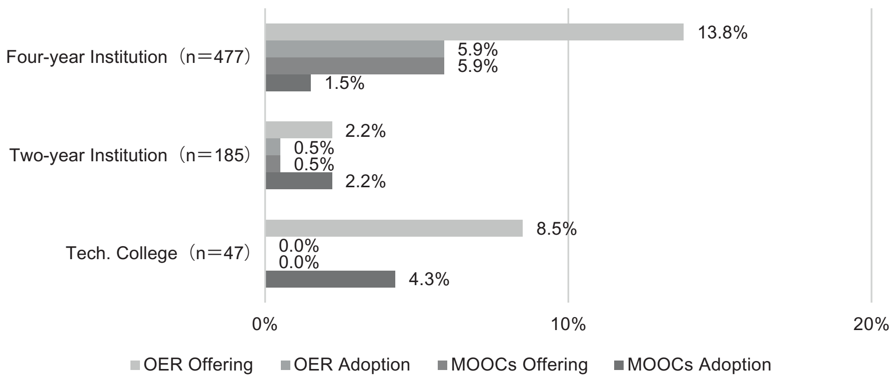

Fig. 13.2 Offering and adoption of OERs and MOOCs

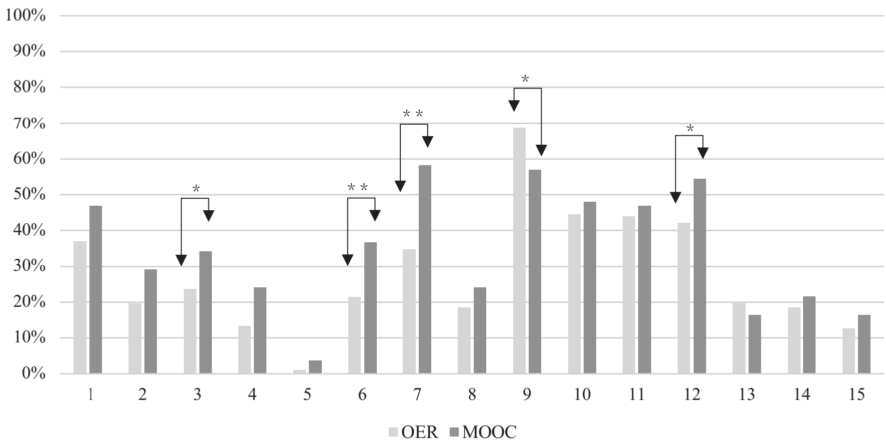

Fig. 13.3 Purposes of offering OERs and MOOCs. *: $p < 0.05$ **: $p < 0.01$. (1) Recruitment of high school students, (2) Recruitment of foreign students, (3) Recruiment of domestic students, (4) Recruiment of domestic graduate students, (5) Support for job change, (6) Support for professional development, (7) Support for lifelong learning, (8) Service for alumni, (9) Improve learning environment for students, (10) Wider selections of educational opportunities, (11) Promote educational information, (12) Social contribution as a higher education institution, (13) Collection of learning data for educational improvement, (14) Faculty development, (15) Collaboration among universities

"Promote educational information," "Social contribution as a higher education institution," and "Recruitment of high school students" recorded the highest responses. By type of institution, "Improve learning environment for students" received the highest response for all three types of institutions. Regarding the reasons for offering MOOCs, favorite responses included "Social contribution as a higher education institution," "Recruitment of high school students," and "Support for lifelong learning."

Figure 13.3 shows a comparison of the reasons for offering OERs and MOOCs. A statistical analysis of these reasons revealed a significant difference between "Improve learning environment for students" ($\chi^2 = 3.336$, $p < 0.05$), "Recruitment of domestic graduate students" ($\chi^2 = 4.517$, $p < 0.05$), "Support for professional development" ($\chi^2 = 6.586$, $p < 0.01$), "Support for lifelong learning" ($\chi^2 = 12.338$, $p < 0.05$), and "Social contribution as a higher education institution" ($\chi^2 = 3.267$, $p < 0.05$). OERs are considered useful in the provision of educational materials that are differentiated based on the level of each student and that complement the content of the course. On the other hand, MOOCs are considered to provide for the recruitment of students, professional development, and lifelong learning.

13.8 Conclusion: Future Perspective for Open Education Practices in Japan

The use of open education practices in Japan has still not become widespread. Although the number of higher education institutions to develop and use OERs or MOOCs is increasing, only a minority currently use them.

On the other hand, in Japan, a nonprofit organization called Asuka Academy translates English-language OERs into Japanese and makes it available for free (Asuka Academy 2019). High school students participate in this OER translation as part of their English learning (ICT eNews 2015). A governmental project to utilize MOOCs for human resource development in rural areas is ongoing (Cabinet Office 2019). Open education practices not only enable improved learning outcomes but also offer the opportunity to support professional development. Open education is expected to serve as infrastructure that supports online learning in the region.[1]

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Chapter 14
A Critical Review of Emerging Pedagogical Perspectives on Mobile Learning

David Longman and Sarah Younie

14.1 Introduction

This chapter is the outcome of an ITTE[1] Scholarship project (2016–2017) to produce a synopsis of the mobile learning (ML) landscape as formulated in the academic literature up to the end of 2017. The purpose is to clarify by critical analysis some key ideas that are emerging about the special pedagogical characteristics of mobile learning (ML) based on the use of mobile educational technology (MET). The aim is to guide further research productively in order to contribute to our developing practice about how to describe and deploy MET for effective teaching and learning.

While there is a significant level of enthusiasm about the educational potential of MET at the present time, there is little evidence of systematic benefits or repeatable outcomes beyond occasional demonstrations of the practical feasibility of using MET in some contexts of formal or informal learning. However, ML is a dynamic domain with emerging possibilities requiring continuous research as new devices, services, and software are developed. This dynamism presents innovative, sometimes controversial, challenges to the development of sustainable, well-integrated pedagogical practices.

[1] Since this chapter was written ITTE, the Association for Information Technology in Teacher Education has changed name and is now known as the Technology Pedagogy and Education Association (https://tpea.ac.uk), to be aligned with the name of the journal that the association founded.

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An overall assumption throughout the literature is that the increasing prevalence of MET since the early years of the twenty-first century signifies an opportunity for pedagogical transformation. However, in this chapter, we take a more reserved position mindful that educational technology has long promised transformation regardless of its ‘footprint’:

> Education is on the brink of being transformed through learning technologies; however, it's been on that brink for some decades now. (Laurillard 2008)

Three key aspects of the literature frame our discussion. The first is that the mobile form factor (the design patterns that define and prescribe the size, shape, and other physical specifications of components) continues to evolve into an increasingly common approach to accessing software, Internet resources, and online services. Broadly, it has become the dominant form in most regions of the developed world where personal ownership of devices continues to grow very rapidly with 90%-plus ownership rates common (Deloitte 2017). This growth in ownership in wealthier nations such as the USA and the UK takes place alongside an established, high rate of ownership of ‘traditional’ desktop form-factors. Data show that mobile devices are overtaking these more traditional form-factors as the primary mode of network access (Guardian 2016) and a similar pattern follows in emerging economies where the desktop has always been a less prevalent mode of use (Pew Research Center 2016).

The second focus of discussion concerns the increasing capability of the physical and software components built into the motherboards of mobile devices. High-resolution displays, GPS, photography, and a variety of connectivity options have become standard features in mobile devices. Recent developments in the capacity of digital sensors and software to capture biometric data such as facial and fingerprint recognition coupled with greater processing power for natural language or haptic interaction are also becoming routine technical features.

The third important aspect is the concurrent and widening public concern about the effects, positive and negative, of the commercialisation and exploitation of social media and the socio-political fallout from these effects. These concerns particularly bear on the discussion about the educational value of mobile devices not only because of anxiety about the unregulated accumulation and financial exploitation of personal data but also about the potential manipulation of human cognitive and affective development.

Nevertheless, mobile technologies (and computational technologies in general), are to be celebrated for the potential enrichment they can bring to everyday life and in particular to education and learning. The wider concerns regarding social media have different solutions for different phases of education, particularly where safeguarding practices are paramount. Given the relative ubiquity of mobile devices (Pew Research Center 2018), this enrichment could be considerable, assuming that effective pedagogical approaches can be identified.

In this chapter, we put aside the easy promise of a transformation of education and aim to focus on an emerging ‘framework theory’ of ML with particular attention to how such a theory explains the development of knowledge, skills, and values.

The selected academic papers we have reviewed generally adopt a social constructivist conception of learning with technology. Constructivism has informed the debate about effective ways to harness computers for learning since at least the late 1960s (MIT Media Lab 2017) and socio-cultural theory tends to be a common perspective in depictions of how ML works, often drawing on sources such as Vygotsky (1978) and Wertsch (1991) (e.g. see Kearney et al. 2010). By contrast, national policies in many of the world's education economies continue to favour curriculum prescription and performance targets, although development is often inconsistent across systems: '… school coverage increases but learning does not'. (World Economic Forum 2014).

> Learners are no longer well served by only being exposed to traditional instructionist teaching approaches ... in formal spaces designed for the needs of yesterday's society. They also need to be able to learn in new and flexible ways that prepare them to function well in tomorrow's world. Yet our ways of preparing students for this future have not changed radically and our views of effective learning are mired in past thinking. (Schuck et al. 2016, p 2)

However, ML does not yet offer a clear alternative model of pedagogical action through curriculum design, assessment or accreditation although an early and exceptional example is the eViva project run by Ultralab (McGuire et al. 2004). In particular, as in the previous quote, the teacher is often associated with negative descriptors such as 'static', 'controlling', or 'didactic' but with little guidance on how the role must change:

> Despite the potential of mobile technologies to be used as powerful cognitive tools ... within a more constructivist approach to teaching and learning, their current use appears to be predominantly within a didactic, teacher-centred paradigm. This trend in the use of mobile devices is following a typical pattern where educators revert to established pedagogies as they come to terms with the affordances of new technologies ... 'one step forward for the technology, two steps back for the pedagogy'. (Herrington and Kervin 2007, p 176–177).

Thus for authors such as Traxler (2016), MET has a clear disruptive potential and represents an important shift in the power and authority relationships that obtain in education:

> Now, for reasons of cost and sustainability, the focus has moved to 'learner devices', those owned by learners ... and with it the locus of agency and control has moved from the institution to the learner. (Traxler 2016, p 193)

In addition, MET is seen to offer both a bright future for learners and an altered, if unspecified, *affective* landscape:

> …[with] a rapid change in the ownership of powerful digital technologies for learning. [From] … uniform network desktop computers in educational institutions [to] ... highly functional but diverse and rapidly changing personal mobile phones ... This represents a change from uniform institutional hardware ... to individual mobile phones, expressing individuality and thus taking a different emotional place in the learners' context. (Traxler 2016, p 194)

This is a dramatic outlook and perhaps the presence of mobile devices will push us towards a very different and potentially separate form of education system:

> … A shift of context-aware mobile learning from a component of mobile learning to the educational component of context-aware services and experiences ... outside education and its institutions …" (Traxler 2016, p 195)

14.2 Challenges for Learning and Teaching

Traxler's (2016) vision suggests that ML can be an alternative to organised education but no clear pathway to reach that alternative is laid out. Cerratto-Pargman and Marcelo (2016) discuss factors that mitigate against the integration of successful small-scale ML projects into sustainable components of a school curriculum. They surveyed a number of ML projects across Europe including three classroom projects using mobile apps in mathematics and environmental fieldwork using a variety of sensors to gather measurements of natural features. While all three projects provided valuable evidence of gainful and pleasurable learning, enjoyed by teachers and students alike, they did not appear to effect longer-term change:

> ...mobile learning research and school practise are growing apart. Surprisingly, few are the studies interested in finding out how to maintain the use of innovative devices in schools and how technology can become part — or not — of the fabric of the school world. (Cerratto-Pargman and Marcelo 2016, p 157)

They argue that research needs to investigate factors at different levels of organised education: the *macro* level, i.e. the national policy context; the *meso* level, i.e. the school as an institution serving a community; and (the *micro* level, i.e. the classroom where teaching and learning happens. All bear on embedding sustainability (see also Sharples 2016; Wishart 2017; Davis 2017). For example, at the macro level different stakeholder voices present varying, sometimes competing perceptions about the value and purpose of technology whereas at the micro level clear statements of purpose are needed to guide classroom teaching (Cerratto-Pargman and Marcelo 2016, pp. 170–174).

In a similar vein, Haßler et al. (2016) undertook a rigorous systematic literature review of empirical research to identify learning gains (in terms of knowledge and skills) that might result from mobile tablet use and what factors contribute to successful use. From a set of 103 studies, they identified only 12 that they rated highly for methodological quality. Of these, nine reported positive learning gains and three reported no change. The studies covered a wide range of sample sizes (from one to several thousand) and curriculum domains (from improving reading to cardiopulmonary resuscitation).

Identifying also that none of the projects reviewed had developed into sustainable forms of classroom practice, they noted project shortcomings resulting from factors such as ineffective project management; technological failures through a lack of infrastructure support; insufficient professional development to ensure participating staff could use the mobile devices; and staff capacity to adapt their teaching and learning practices. All these factors require time to get right including the emergence of any potential benefits for learning (Haßler et al. 2016, p 151–152).

They further observed that the ML literature tends to focus on the *micro* level of teaching and learning activity, that is, what the teachers and students do together. Professional development needs are frequently identified, but ML itself appears to have had limited effect in addressing these needs, except where it is most obviously useful, for example, accessing relevant information or sharing observations with others (e.g. see Schuck et al. 2010). A pressing requirement is for time to experiment with mobile devices in a relevant context such as classroom teaching. This must be provided through the meso level where school leadership and external resources are brought to bear (Cerratto-Pargman and Marcelo 2016).

In parallel, as the ideas and practices of ML mature, the attitudes, motivations, and characteristics of learners are also expected to undergo a shift towards autonomous, self-directed, and self-regulated learning behaviour. Such characteristics are typically not thought to be developed by 'traditional' organised schooling where structured time, curricula, and teacher-centred pedagogies are perceived to militate against learner-centredness. 'The emphasis is upon the subordination of the learner to place and space rather than on analytical control'. (Ball 1993, p 202). In the literature on ML, mobile technologies are often presented as a challenge to this viewpoint by offering a vision of a learner-centred and learner-controlled model of education.

Yet there is little direct modelling of learner characteristics in ML settings and how these might be developed and sustained. Indeed, the literature relies on a broad assumption that learners will have no difficulties with using MET for learning. Pedagogical considerations relating to an individual's capacity for acquiring, synthesising, and transforming content while in a flexible, negotiated, and on-demand setting are rarely explored.

Terras and Ramsay (2012) outline five 'psychological challenges' which can affect the quality of the individual mobile learning experience. While they argue that the 'anytime' aspects of ML have become culturally embedded in the context of a rich online information and services environment, the idea of flexible location is more problematic:

> Anywhere really does mean anywhere and it is anticipated that the mobile owner will be able to exploit this. The anywhere access afforded by mobile technology is not only its greatest strength but also its greatest challenge. (Terras and Ramsay 2012, p 822)

Challenge 1: The Context-Dependent Nature of Memory

Memory is susceptible to the influence of context and the 'supportive effect of context' on recall and memory retrieval can be disrupted when the context of initial learning is different from the context of recall. Thus, memory of mobile-based fieldwork might not be readily recalled or organised when needed in a new context such as a classroom.

Challenge 2: Limits on Human Cognitive Resources

Working memory and attention have limited capacity. Combined with the distraction of extraneous features and events which not only include the working environment but also the mobile devices themselves learners 'may need to develop superior attentional control' because such distractions 'may degrade the quality of their learning experience'.

> The challenge is twofold: education providers must provide the 'richness' and reduced ambiguity of face-to-face learning, while delivering it over a 'lean' and mobile medium … (Terras and Ramsay 2012, p 825)

Challenge 3: Distributed Cognition and Situated Learning

Cognition and learning is influenced significantly by social and contextual factors, but increasing the 'density of the distributed cognitive network' (p 825) adds a need to be selective and judicious about which inputs, individuals or groups in such networks are of value. We note here that commentaries about the potential of ML for providing access to 'authentic' learning experiences such as participation in a community of practice tend to assume that such participation is unproblematic for learning.

Challenge 4: The Essential Importance of Meta-Cognition in Mobile Learning

Meta-cognition is a crucial element of learning. Qualified teachers will be familiar with the concept of the reflective practitioner (Schön 1983), as an example of a model of meta-cognition for learning. For Terras and Ramsay a self-aware approach to learning relates to what psychologists refer to as 'executive functioning':

> … with the ability to self-monitor and self-manage in mobile learning contexts … the effective mobile learner will be the one who both *acknowledges* the challenge of interruptions and also *plans and manages it*. (Terras and Ramsay 2012, p 826).

Challenge 5: Individual Differences in Technology Use Matter

It is important for learners (and teachers) to understand how differences in technology can be used for achievement and success. This works in two directions. Learners, individually or in groups, need to appreciate these differences, and also teachers need to understand how their use of digital technologies can shape perceptions, preferences, and experiences for learners. Broadly speaking, educators cannot assume that learners have the same skills and understanding of the use of MET nor can educators presume that there is a preferred 'best' set of skills.

14.3 A Framework for Mobile Learning (ML)

A closer look at an example of a descriptive framework for ML provides an illustration of the issues involved in developing a generalised model of mobile learning. In recent work (by Kearney et al. 2012, 2015; Burden and Kearney 2016a, 2016b; Schuck et al. 2016, with antecedents in Traxler 2007 and Traxler and Wishart 2011) distinctive 'signature' pedagogies are proposed as a key characteristic of ML.

Kearney et al. 2015 (based on Kearney et al. 2012) identify three 'signature pedagogies' of ML:

- Personalisation
- Authenticity
- Collaboration

They develop their framework with a social constructivist and socio-cultural approach to teaching and learning:

> Central to our position here is the notion that learning is a situated, social endeavour, facilitated and developed through social interactions and conversations between people (Vygotsky 1978), and mediated through tool use (Wertsch 1991). (Kearney et al. 2015, p 1)

Drawing on evidence from two projects undertaken in higher education and teacher training settings, they focus on the presence of the mobile device as a mediating tool in learning. Arguing that time and space are fundamentally restructured by the use of mobile devices, as do some proponents of ML such as Traxler's vivid suggestion (2007) of '...learning whilst travelling, driving, sitting, or walking...', so the motifs of containment, control and linearity come to typify the character of traditional classrooms:

> ...the requirement to learn in fixed, scheduled time spaces (which characterise current schooling) are (sic) also relaxed enabling the individual to be more flexible about when they learn. […] Fixed notions of linear time are increasingly making way for a softer version of 'socially negotiated time' in which each party to an event is able to create and rearrange their schedules without excessive detrimental effect to either side. (Kearney et al. 2015, p 4)

Although principally addressing higher education, even in that setting flexibility of learning may not be too readily achieved through the presence of MET because, at the present time, universities remain bound by constraints of time and resources to offer students an organised and progression-based curriculum.

This idea of time-space flexibility or 'malleable spatial-temporal contexts for learning' (Kearney et al. 2012, p 4) could be possible in higher education where learners are presumed to be responsible, self-directed adults but not so readily in the context of 'current schooling' (ibid) which is certainly not 'malleable'. The notion of 'socially negotiated time' on which these ideas rest also disguises a range of wider socio-economic issues about the emergence of a 'gig economy' where 'flexible' working is determined by employer demands and is typically non-negotiable by the employee (Standing 2011).

Table 14.1 The subdivisions of the signature pedagogies

Time-Space	Personalisation	Situatedness
		Contextualisation
	Authenticity	Conversation
		Data sharing
	Collaboration	Agency
		Customisation

Adapted from Kearney et al. (2012), p 8

Kearney et al. (2012, p 8) elaborate the signature pedagogies to indicate further subdivisions of pedagogical activity as illustrated in Table 14.1.

Methodologically, the framework described here was based on a consensus derived from a critical discussion within a group of academic peers rather than from an empirical investigation of the effects of mobile devices in concrete teaching and learning situations. It builds on work described in Kearney et al. (2010) and Schuck et al. (2010) but both papers rest on a combination of 'proof-of-concept' experiments that *presuppose* the model rather than test it in practice.

In the earlier 'Mobagogy' project, Schuck et al. (2010) aimed to develop 'a community of learners' among a small group of higher education lecturers and trainee teachers. This was a proof-of-concept project to focus on the use of Twitter for supporting professional development and practice among university lecturers, school mentors, and student teachers (particularly when they were in practice schools). Professional learning outcomes were limited although some potential advantages of mobile devices such as such flexibility in use, convenience, user-friendliness, and usefulness for inquiry-oriented or project-based teaching and learning were identified. A later paper (Schuck et al. 2013) covers the same project but includes recommendations for enabling ML in professional development such as making more time for experimentation, immersion learning, devising authentic learning contexts, and sustaining a professional learning community.

Interestingly, Kearney et al. (2010) develop the concept of 'third space' learning, that is, learning that falls 'between' formal, organised situations such as school or college and informal but organised situations such as field trips. The concept aims to provide a range to the framework by including all forms of teaching and learning situations. Third space learning sits at a socially oriented crossroads of self-initiated and self-motivated learning and appears well adapted to the perceived characteristics of ML:

> We contend that it is in this nexus of the formal and informal [the third space] that levels of flexible, spontaneous, incidental learning are optimised. Experiences in these spaces are more than likely initiated, negotiated and mediated by self or peers, drawing on high levels of social networking, 'in-situ', personalised activities that take advantage of flexible schedules and spontaneous learning episodes. (Kearney et al. 2010, p. 114)

In this third space, we find collaboration, flexibility, and situatedness. However, the description of the Twitter case study (see also Schuck et al. 2010) offers only limited and indirect evidence of third space learning in the form of discoveries by participants about the useful capabilities of the devices, for example, photos of pupils' work, recording conversations, sharing reflections or resources after work etc. Although these examples of 'third-space' learning are important they are indirect, informing us more about the affordances of the tools than their educational purpose.

Thus, the framework provides only a loose representation of how the components of the framework might interact to produce different kinds of learning. For example:

> … while podcast use may sound novel in terms of the informal context and control of task pacing, under closer inspection it mimics a transmission pedagogy with its roots in didactic teaching traditions of formal learning settings. (Kearney et al. 2012, p 14)

While the framework is proposed as 'a guide for practitioners to interrogate their own m-learning designs' (ibid.), the balance of features that might transform a 'didactic' use of podcasts into a 'better' or more effective ML activity is unclear. One consequence, for example, is that flexibility of learning (a core feature of ML according to the authors) could be compromised if this balance is not understood.

The idea of context is a key but elusivefeature of ML. The effects of contextual varation can increase ambiguities in determining the effectiveness and value of ML. The podcast example above highlights this ambiguity for it implies that although a podcast has a somewhat fixed pedagogical role as an instructional tool it may yet form a component in a more flexibly structured ML activity.

From an early stage in the emergence of the framework here under discussion ML has been defined in relation to context, as in Traxler and Wishart (2011) who suggest that ML '…can enhance, extend and enrich the concept and activity of learning itself' in several ways (p 6):

1. Contingent mobile learning and teaching (where learners can respond and react to their environment and changing experiences, and where learning and teaching opportunities are no longer predetermined)
2. Situated learning (where learning takes place in surroundings that make it more meaningful)
3. Authentic learning (where learning tasks are meaningfully related to immediate learning/professional goals)
4. Context-aware learning (where learning is informed by the history, surroundings, and environment of the learner)
5. Personalised learning (where learning is customised for the interests, preferences, and capabilities of learners)

(Traxler and Wishart 2011, p 6–7)

Here, each 'type' of learning is defined by its context and for completeness, 'context-aware learning' is also defined in terms of contextual features! There seems to be an unhelpful circularity in these definitions.

Later papers, for example Traxler and Kukulska-Hulme (2016a), go on to use the phrase 'context-aware mobile learning' to emphasise the capability of a device to gather data from the user's surroundings via any number of sensors embedded in the device. Again, there is ambiguity here for although mobile devices incorporate sensors to capture external data, the value and utility of these data for the end-user is entirely dependent on third-party software, including the pre-processing carried out by the operating system of the device. The determination of what contextual features are significant is similarly entirely dependent on the particular configuration of the mobile device and the meaning of such contextual data for the learner is not necessarily self-evident. Moreover, the reliance on embedded and automated processing to present or utilise such data begs a significant question about the pedagogical assumptions of the processing.

Educators have long understood that what, where, and how learning takes place are significant because they strongly influence achievement and attainment. However, Traxler (2016) while commenting on the problem of definition nevertheless puts forward a strong claim for the significance of mobile learning:

> The notion of context has been one of the defining contributions of mobile learning to the wider field of technology enhanced learning exploiting the personal and portable nature of the devices and their capacity to sense some aspects of their context, initially their location and trajectory context.(Traxler and Kukulska-Hulme 2016b, p 190)

However, Sharples (2016) points out that there are many different ways that societies deploy educational technology for learning. In turn, this presents us with a great variety of contexts in which ML might be developed. Although there is no '... guaranteed way to enhance learning by providing access to educational content anywhere, anytime' (p 151), it is important to develop our understanding of the ways in which different kinds of context affect the learning process.

Sharples (2016) therefore offers descriptions of three learning situations to illustrate some of the different ways in which context constrains or structures learning activities with mobile devices:

- Context as an '*ecology of managed resources*' – for example, a classroom-managed directed activity such as children writing book reviews.
- Context as *container* – for example, an art-gallery tour using QR codes used to trigger podcasts about exhibits plus the use of recordings and cameras to log visit.
- Context as *location* – a geography fieldwork activity in which students asked to evaluate new digital measuring devices.

  (Sharples 2016, p 151).

In his example of the art-gallery tour not only is the tour structured with a combination of digital resources (audio narrations triggered by sensors; recordings of conversation; photographs, etc.), but the group itself is described as forming its own micro-context or 'micro-site' of activity to discuss and record observations and reflections on what they have been viewing. Yet the idea that contexts can generate more contexts (ad infinitum*?*) adds further complexity because it becomes less straightforward to know what learning has occurred or how the organisation of learning helped or impeded learning.

The powerful technical capability of MET to collect external data alongside the contingent character of contexts in which learners detached from traditional formal settings may work simultaneously presents a range of new social, educational, and political difficulties. As long as we require, or are required, to be accountable for the effectiveness of education then ML can present formidable challenges to professional as well as learner autonomy.

The ensuing discussion about the personalisation aspect of the framework seems to assume that contextual 'acquired information' is unproblematic

> Emerging context-aware capabilities allow devices to acquire information about the user and their immediate environment (e.g. time, location, nearby people and objects), presenting unique opportunities to personalise learning experiences. (Kearney et al. 2012. p 9)

The automated transformation of personal data through largely invisible processing has already become a crucial problem of social, political, and economic transparency. According to O'Neill (2016), such automation can be particularly pernicious when applied to social activities such as teacher performance, educational assessment, crime and justice, or personal finance. Personalisation it would seem is not something that we necessarily own or control.

There is a further observation to be made about the art gallery visit (also described in Sharples 2013). Seemingly good infrastructure support enabled the use of prepared media resources and recording tools for the young students to gather their own perspectives about the artefacts and data that were automatically stored to a project server thus rendering it accessible from the classroom. Touring the galleries was exciting and fun, but once returned to the classroom it was more difficult to organise the collected material into structured artefacts such as reports and presentations. Whereas using the mobile devices informally as collection devices presented little difficulty, using the information for a purpose in a different context seemed to do so.

Clearly, the learners in this gallery project had a skill set such that they could read, listen, follow directions, take photographs, and record conversations. Nevertheless, that skill set did not readily transfer between the gallery and the classroom without guidance and/or planning when the context changed. This underlines the psychological challenges described by Terras and Ramsay (2012) and, it should be noted, for Hattie and Donoghue (2016) 'transfer' between contexts of learning is the highest aim of learning, '… a dynamic, not static, process that requires learners to actively choose and evaluate strategies, consider resources and surface information ...' (p 4). 'Adaptive skills' need to be taught in order to ensure effective transfer of learning.

This is further borne out in a survey by Kearney et al. (2015) where personalisation ranked lowest of the three framework constructs in relation to classroom activities:

> The flexible, potentially personalised nature of m-learning commonly characterized by phrases such as 'anywhere any time' 'any place any pace' or 'just in time, just enough, just for me' (Traxler 2009) was not evident in many tasks described by the ... teachers in this study. This highlights a need for further investigation and professional development ... in order to understand ... the barriers which limit the amount of agency which students can expect to experience in these m-learning episodes. (Kearney et al. 2015, p 55)

14.4 Conclusion

Mobile learning clearly has the potential to extend the repertoire of educational practice and opportunity. However, there seems to be no overwhelming case for considering it an *alternative* mode of education as some of the authors here reviewed have suggested. Of course, it can be an extension to current practices and there is an opportunity to transform some aspects of current education. Much of the discussion reviewed in this chapter is 'proof-of-concept' derived from observational studies or small-scale experiments using MET mobile devices deployed experimentally in a range of situations from formal classroom settings (e.g. Carter et al. 2016) to the loosely structured world of geocaching enthusiasts (e.g. Clough 2016).

In this chapter, some emphasis has been given to some of the issues that arise for claims about the role of 'context' in learning, or that the 'context-aware' character of MET lends it a special power in supporting learning effectively. The aim has not been to demolish those claims but to suggest that greater clarification is required on the road to building a pedagogical theory of mobile learning. Ambiguities abound. In their 2015 survey, Kearney et al. (2015) found that teachers consistently gave high scores to 'authenticity' as a characteristic of ML. This seems surprising because the teachers were '...situated in formal institutional settings such as school and universities which might normally be considered rather inauthentic settings'. (op. cit., p 28). The authors describe this as a paradox but note that '… teachers conceptualise the construct of authenticity... around … the tool and the task, not only the setting'. (op. cit., p 55). Thus, learning tasks that scored well for authenticity were those where more realistic tools and apps were used such as music, photography, and graphics. In short, the tools *are* contexts for authentic learning.

The ML frameworks analysed in this chapter can be applied to different phases of education, from early years through primary, secondary, tertiary, and higher education. However, throughout the reviewed literature little regard is given to the differences between these settings. Many of the studies that do describe higher education contexts do so with mixed results. Those that have looked at earlier phases inevitably highlight limiting cases such as the necessity for more deliberate and explicit guidance by teachers at primary, or the need to plan for transfer between learning contexts.

There can be a tension between a descriptive purpose of the particular frameworks reviewed here and an evaluative purpose. With little evidence to guide the differences between these purposes, qualitative judgements about such desirable pedagogical aims as authentic learning, contextual control or the personalisation of learning afford might not realise the anticipated advantages of ML. Moreover, the underlying assumption of a significant sociological shift in the pattern of daily life, away from 'scheduled time' towards a more opportunistic and unpredictable pattern, remains speculative:

> By placing mobility of learning as the object of analysis we may understand better how ... new technologies can be designed to support a society in which people on the move increasingly try to cram learning into the gaps of daily life. … a theory of mobile learning must

> therefore embrace the considerable learning that occurs outside offices, classrooms and lecture halls. (Sharples et al. 2011, p 3)

ML is presented as a contrast to the deficiencies of current educational practice and, by implication, ML is presented as an antidote. Thus, with its appeal to personalisation and intrinsic motivation, Third Space learning locates ML in a learner-centred tradition of educational thought. However, in spite of the obvious practical usefulness of mobile devices such as tablets and smartphones there is little explanation as to how this might be fully developed into a systematic approach to organised education. The obstacles to transforming education in this way are not merely ones of classroom practice or, more specifically, the reluctance of teachers to relinquish control over the direction and content of learning.

The question of teacher agency in ML and whether or not there is too much or too little of it is a significant and fundamental one. Against the portrayal of education as a mechanistic assemblage of scheduled learning times, scheduled curricula, memorised outcomes, and so forth, ML is portrayed in terms that release learner relevance, learner choice, and learner-centredness:

> Learning that used to be delivered 'just-in-case,' can now be delivered 'just-in-time,' 'just enough,' and 'just-for-me.' (Traxler 2007. p 2)

However, as Terras and Ramsay (2012) have argued, we cannot ignore the psychological issues surrounding the use of mobile devices in learning. Every learner who shares creatively generated content must also receive content from others that in turn needs to be interpreted, understood, and curated for some purpose. Managing that back and forth flow of rich content presents a significant organisational and pedagogical problem for which we have, as yet, few answers. A key question is therefore: how can 'seamless' learning avoid creating a fragmented learner experience?

ML must address its own version of pedagogical agency that might be characterised as the 'teacher-in-the-network', a hidden pedagogical hand. If teachers are not present in real time to offer support, guidance, or feedback, then how will ML support our capacity for learning, our 'prospective memory', whereby we plan and manage our actions?

Appendix: Pandemic Postscript

Since this chapter was written, the digital learning landscape has been dramatically transformed by the global emergency of the Coronavirus pandemic affecting all aspects of public life including education. Across the globe, there has been a significant shift to online alternatives to classroom-based education for all levels of school and higher education (with significant variations from place to place). This shift will likely continue for 2–3 years with unpredictable longer term consequences for the potential of digital learning.

The rapid adoption of online provision across the UK has been sudden, disruptive, at times chaotic, and variable in effectiveness and impact for different learners. Several general considerations have emerged from the experience of 'lockdown learning' so far:

- Social inequality has been dramatically and negatively affected overall, with disadvantaged populations gaining much less benefit from the online provision, due to lack of devices and access among other factors.
- The patchy, uneven development of digital learning in UK schools alongside many years of funding reductions has exposed significant gaps in resources and infrastructure.
- The long-term direction of UK educational policy has increased the role of private sector interests in the management and development of education, including educational technologies in schools, alongside reduced teacher autonomy.

These considerations perhaps help to emphasise that claims made for mobile learning outlined in the chapter are some way from realisation. The UK government opted to supply thousands of laptops and broadband connectivity to disadvantaged school pupils (those on free school meals). Simultaneously the Oak National Academy was set up to provide a bank of online resources, mostly a collection of talking heads videos and worksheets, for pupils working from home because schools were closed or because they are required to self-isolate.

The distribution of laptops has been fraught with bureaucratic delays and rule changes (Guardian 2020a) and there is little sign that broadband connectivity has been extended. That laptops have been the preferred tool of choice (rather than mobile devices) is also indicative of a degree of 'traditionalism' in the outlook of developers of the online response, which, in the case of Oak National Academy (ONA) personnel has included many who are '...well-connected to DfE policymaking' (TES 2020).

In England, at least, ONA has created a 'classroom-in-the-home' style of teaching/learning (i.e. children sitting down to watch and listen to talking heads with 'exercises' on their laptops, if they have access to one), a format that has been criticised in the research literature reviewed in the chapter. Yet ONA's own download statistics in the week beginning on 19 October 2020 indicate that 63.3% of downloads were to desktops, while 25.7% were to mobile phones, and 9% to tablets. We presume that 'desktops' includes 'laptops' and while the numbers for mobile phones are suggestive there is little data as yet to describe in detail how this usage affects learning experiences. There is little sign that tablets or smartphones have been directly encouraged or supported as a directly useful form of educational technology. (Wired 2020).

Thus, mobile educational technology has not figured too obviously in the English approach. A more serious issue, however, emerges with the increasing evidence of 'learning loss'. While reflecting upon the research literature reviewed in the chapter, we consider that it gave too little attention to the important role of teachers in supporting and guiding learners and overemphasised the properties of the technology at the expense of the social conditions of use. Technology notwithstanding, too many disadvantaged young people have missed months of education thus intensifying the educational inequality they already experience (Guardian 2020b; IFS 2020).

The chapter concluded with the suggestion that when mobile learning relies on a 'teacher-in-the-network' (a hidden pedagogical hand particularly in the form of embedded and automated processing) new risks emerge. The effects of the current approach to online learning, admittedly an emergency response, make it clear that the acute reduction in the more direct, interactive relationship with real teachers and other learners is damaging for students. Online learning may become a routine component of education for at least the next few years because assuming an effective vaccine appears soon its impact on 'lockdown' measures is at least 2 years away (BBC 2020). Therefore, it is important to think again about the limitations of current online learning models that emulate 'teacherless' classroom-based learning. When that rethink occurs, mobile learning may be well placed to offer considerable scope for innovative approaches to enhancing lockdown learning.

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Chapter 15
Implementing Open Pedagogy in Higher Education: Examples and Recommendations

Evrim Baran, Dana Al Zoubi, and Boris Jovanović

15.1 Introduction

Open educational resources (OER) are growing at a rapid rate with an increasing number of projects and initiatives in different scales. The concept of open educational resources was first presented at the United Nations Educational, Scientific, and Cultural Organization (UNESCO) forum, and refers to "the open provision of educational resources". Since then, there has been an increasing movement toward open education and OER to improve online access to teaching and learning resources (UNESCO 2002). The definition of OER extended to "digitized materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching learning and research" (OECD 2007, p. 10). OER created worldwide enthusiasm for their premises in enhancing content accessibility and free open sharing of online learning and teaching resources (Hegarty 2015). OER can be re-used, revised, remixed, and redistributed, allowing for the modification of learning content to fit various contexts (Wiley 2010). The cost-saving potential of OER provides alternative solutions to the rising cost of textbooks in higher education (DeRosa and Robinson 2017). However, some challenges emerged with OER movement such as keeping track of the process of developing OER (Browne et al. 2010), copyright issues (Atkins et al. 2007) and the quality and sustainability of available OER (Bliss et al. 2013). Moreover, there is no one-size-fits-all model that could be adapted to facilitate OER implementation in different institutions (Hilton 2016).

While the OER movement continues to grow and expand around the world with an increasing number of OER and open courses (e.g., massive open online courses

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(MOOCs), researchers highlight a need to move beyond content-centered and technology-focused approaches to open educational practices (OEP) (Ehlers 2011). OEP can be defined as a broad spectrum of practices that encompasses "creation, use, and reuse of OER, as well as pedagogical practices employing participatory technologies and social networks for interaction, peer learning, knowledge creation, and empowerment of learners" (Cronin 2017, p. 18). OEP is an overarching multidisciplinary construct that connects separate dimensions of openness while focusing on the processes of education in the context of OER (Koseoglu and Bozkurt 2018).

Although most previous research has examined OEP by means of the use and adoption of OER (Koseoglu and Bozkurt 2018), few studies examined OEP in relation to other areas such as open sharing of teaching and learning practices, open assessment, and open source software (Beethman et al. 2012; Cronin and MacLaren 2018).

Open pedagogy emerged as a manifestation of OEP in the design, delivery, and evaluation of OER as an integral part of learning and teaching processes. Engaging in open pedagogy to create OER strengthens student understanding of information ownership, copyrights, licenses, and responsibilities (Wiley 2015). Hegarty (2015) established grounds for open pedagogy by presenting a model of eight connected attributes: (1) participatory technologies, (2) people, openness, and trust, (3) innovation and creativity, (4) sharing ideas and resources, (5) connected community, (6) learner-generated, (7) reflective practice, and (8) peer review. To address the challenge associated with a wide range of definitions of open pedagogy, Wiley and Hilton (2018) coined open-enabled pedagogy as a term to define "the set of teaching and learning practices that are only possible or practical in the context of the 5R permissions which are characteristic of OER" (p. 135). 5R activities include retaining, reusing, revising, remixing, and redistributing content (Wiley n.d.). The term *open pedagogy practice* in this chapter refers to Wiley and Hilton's (2018) definition of OER-enabled practice.

Renewable assignments are one example of open pedagogy practice in a classroom. Influenced by the open education movement, renewable assignments are characterized by their openness and their ability to reach broader community (Seraphin et al. 2018). A renewable assignment, in contrast to an assignment that is discarded after the course ends, uses OER to create value for a larger community by engaging the learner in the creation and sharing of OER materials (Wiley and Hilton 2018). Seraphin et al. (2018) defined renewable assignments as activities that foster learning and engage students in course assignments while providing impact beyond the classroom boundaries. Examples of renewable assignments include engaging students in the development of a class Wikibook (Baran and Uygun 2016), creating test questions based on learned material (Jhangiani 2017), writing Wikipedia articles (DeRosa and Robison 2017), creating videos on course topics (Willmot et al. 2012), developing an open access anthology with students (DeRosa 2015), and crafting a crowdsourced syllabus (DeRosa and Robison 2017).

This chapter will present three cases where open pedagogy was put into practice in a higher education institution. Each case utilized a different form of renewable assignment within a blended, online, and a face-to-face course. The assignments and projects were designed with Wiley and Hilton's (2018) criteria of designing renewable assignments in mind: (1) the student creates an artifact, (2) the artifact has value beyond supporting its creator's learning, (3) the artifact is made public, and (4) the artifact is openly licensed.

15.2 Context

We implemented our open pedagogy approach within the context of a large midwestern research university in the USA. OER was acknowledged, encouraged, and promoted through grant initiatives, workshops, and a variety of online resources in keeping with the university's mission of accessible and shared knowledge. The university offered an open education grant cosponsored by the university library and the office of senior vice president and provost to promote the program and increase the number of university instructors using OER. Instructors across the campus received grants to adopt existing OER, create original OER for their courses, or integrate OER into large courses. We received an open-education grant to implement the open pedagogy approach within the context of the newly offered Aquatic Toxicology course, one of the cases described in this chapter. In each of the following cases, students learned about OER and open pedagogy practices as part of the course content. The open access librarian specialist provided an open access and copyright workshop for students before they engaged in any open pedagogy activity.

Examples of open pedagogy implementation in three different cases include (1) designing an open online course, (2) designing the Learning Environments Design Reading Series, and (3) developing a Wikibook on Aquatic Toxicology.

15.2.1 Case 1: Designing an Open Online Course

This case was conducted within the context of a blended graduate course entitled, "Principles and Practices of Distance Education," offered in Fall 2018. It was a required course in the instructional design certificate program. We adopted the open pedagogy approach by having students: (a) create OER for online learners, (b) support the learning community and content quality through peer feedback, and (c) share artifacts with open licenses. Six graduate students (1 male; 5 females) enrolled in interdisciplinary programs in instructional technology ($n = 2$), applied linguistics ($n = 2$), and instructional design graduate/certificate program ($n = 2$) participated in the open online course content creation.

Three renewable assignments were integrated into the course: (a) designing the "Road to Successful Online Teaching" open course, (b) curating an online education toolbox, and (c) conducting video interviews with online education practitioners. All three renewable assignments were integrated on the Canvas Commons platform under "Road to Successful Online Teaching" open course.

15.2.1.1 (a) Designing the "Road to Successful Online Teaching" Open Course

This was a renewable assignment that spanned the semester. Each team developed a module for the open course, "Road to Successful Online Teaching," on the Canvas learning management platform. Students integrated technology tools and applications within Canvas into their modules. Each module was designed and developed for teachers who would be teaching online. The final product was an open course with three modules developed collaboratively by all class members. The online course module design project included three phases: (a) design proposal, (b) development, and (c) module implementation.

The design proposal constituted the students' starting point for the project, where they provided a detailed plan for their open course module. The proposal provided the module title, a clear main goal mission statement with general learner environment outcome, potential audience identification, and the purpose of the open course module. Each team conducted at least two interviews with potential learners (in-service teachers, technology specialists, and other educational practitioners) who expressed interest in teaching online, and subsequently presented a learner analysis of the interviews including emerging themes on online learner needs, challenges, solutions, and potential topics of interest. Students listed in their proposals the specific objectives they wanted their participants to achieve in the overall module as well as prepared OER material on their selected topic and included it in their content description. They then conducted research on their topic, gathered prepared OER materials, analyzed the content, and selected OERs that could be re-used, adopted, or revised following common creative licenses. An outline containing module headings was agreed upon in class to assure all modules had similar organizational flow and coherence. Students provided a detailed plan that described each activity they intended to integrate into their module. They also prepared a plan for conducting assessment techniques that matched the learning objectives, and a plan for implementation, management, and time scheduling.

Students completed two prototypes to ensure online module usability. In each phase, students engaged in peer feedback and reflections on areas needing improvement. Each team presented their modules at the end of the semester and provided an overview of their learning outcomes. All class members contributed to the design of the course main page, as seen in Fig. 15.1.

15.2.1.2 (b) Curating an Online Education Toolbox

The online education toolbox was designed as a renewable assignment that can be reused and improved by future students after initially being created for the course. Throughout the semester, students analyzed the affordances of various online technologies and pedagogical strategies, thus contributing to the open content on the "online education toolbox." This tool served as a repository for teachers interested in teaching online. The toolbox categories included (a) technology and pedagogical

Fig. 15.1 Open course main page

strategies, (b) examples, (c) references, resources and links, and (d) tags/keywords/categories. Students engaged in toolbox entries weekly throughout the semester.

15.2.1.3 (c) Online Practitioner Video Interview Series

This renewable assignment helped students connect with online education professionals with whom they created a professional dialogue on issues related to online learning and teaching. Students conducted interviews with online education practitioners, prepared interview reports, and contributed to the YouTube video series. First, students created interview guidelines and questions to help them gather information regarding successful online teaching practices and ways to support teachers in designing, developing, and evaluating online courses. Second, online education practitioners and instructional designers on campus were contacted for interviews. Each student scheduled a time and a place for an interview and recorded it with a video camera and microphone. Students asked practitioners questions about their experiences, definition of effective online education, learning strategies vital for an effective online learning experience, benefits, and challenges of online education.

Students then edited the interviews following standards established by class members for video recording and editing. The instructor published the videos on YouTube as well as on the open course Canvas commons page.

15.2.2 Case 2: Designing the "Learning Environments Design Reading Series" E-Book

This case was conducted in an online graduate course on Advanced Learning Environments Design. The open pedagogy approach followed in the course included the integration of a renewable assignment that consisted of designing the "Learning Environments Design Reading Series" open e-book, a repository of synthesized seminal readings on topics related to learning environment design. This renewable assignment was inspired by the Open Education Reader (https://openedreader.org/), a collection of readings on open education developed by Dr. David Wiley and his graduate students.

The e-book included a collection of seminal readings with commentary on different areas of learning environment design. Six graduate students (3 males; 3 females) enrolled in human computer interaction and educational technology graduate programs participated in this renewable assignment. The first course assignment required students to synthesize and present notes on selected articles, and to share examples and discussion questions that might help future readers who are interested in exploring the topics. Students analyzed at least three pioneer works for each topic in that field and synthesized them with the following information: reference and link to the article, background, summary of key points, design principles, example work/article/case to illustrate the principle in design/practice, discussion questions, and additional resources. After students prepared initial drafts, the instructor scaffolded a peer review/editing activity that required each student to review one of their peers' chapters using a peer review form. The peer review form structured the peer review by having students provide comments related to the overall chapter structure, writing, and suggestions for improvement. Students prepared final drafts by incorporating changes suggested by their peers and instructor. Once all chapters were submitted, the instructor and teaching assistant placed them on the PressBooks platform: https://learningenvironmentsdesign.pressbooks.com.

Topics covered in the open book include: design thinking, multimedia learning principles, augmented reality and virtual reality, intelligent tutoring systems, flipped learning, and computer-supported collaborative learning (CSCL). Future students who take the same course will study chapters created in this first edition and contribute to the collective work by adding new sections and chapters. Figure 15.2 presents the book cover.

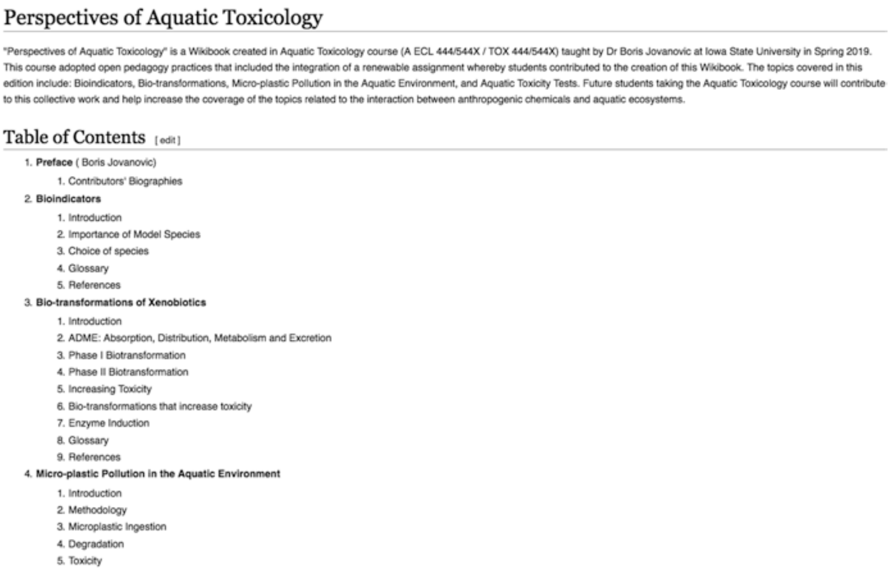
Fig. 15.2 "Learning environments design reading series" book cover

15.2.3 Case 3: Developing a Wikibook on "Aquatic Toxicology"

This case was conducted within the context of a face-to-face course on "Aquatic Toxicology" offered in Spring 2019. The course provided students with an overview of the interaction between anthropogenic chemicals and aquatic ecosystems. The open pedagogy approach included the integration of a renewable assignment whereby students contributed to the creation of the first open textbook, Wikibook. Participants included five students (2 female; 3 male) enrolled in either the Toxicology or Animal Ecology undergraduate or graduate program. Students enrolled in the course created the content of the Wikibook as well as outlined its format such as cover, title, and table of contents published in the Wikibook platform. Students created the first drafts of the Wikibook chapter which included initial content ideas, and headings and subheadings that previewed the intended content. Following instructor feedback on their initial drafts, they presented (a) their topic to their class peers, (b) the information they planned to include in their chapter, and (c) the structure of their Wikibook chapter. During the presentation, they discussed with their peers how to further improve their chapter. The instructor created a discussion thread for students to postconstructive peer feedback following the class presentations. Students were to post at least one constructive comment suggesting how the chapter could be improved, what might be missing, and any further suggestions they had about adding multimedia content to the chapter. Students worked on chapter development throughout the semester. They were encouraged to email multiple drafts of their chapters to the instructor before they submitted their final chapter, if needed. After communicating with the instructor multiple times and finalizing their drafts, students presented their final product to the class and again received comments and suggestions from their class peers. Finally, they engaged in another discussion thread whereupon each student posted at least one constructive feedback suggesting how the chapter could be further improved. The book chapters were sent to the technical editor before being published on the Wikibook platform.

The "Perspectives of Aquatic Toxicology" Wikibook included a general introduction and preface written by the instructor, contributors' biographies, and the three student created chapters on aquatic toxicology. Students formatted each chapter using a similar outline: starting with an introduction followed by six to seven sections discussing in detail the concepts and methods involved with their chosen topic. Students included a glossary of terms as well as references in APA format at the end of each chapter. The topics covered in this edition included: biotransformations of xenobiotics, microplastic pollution in the aquatic environment, and aquatic toxicity tests. Figure 15.3 presents the introduction and table of contents for Wikibook "Perspectives of Aquatic Toxicology."

Future students taking the Aquatic Toxicology course will contribute to this collective work and increase the coverage of topics. New chapters will be added with each subsequent course offering until the Wikibook is completed. It is anticipated that once completed, the Perspectives of Aquatic Toxicology book created by and for students will become a standard textbook on Aquatic Toxicology.



Perspectives of Aquatic Toxicology

"Perspectives of Aquatic Toxicology" is a Wikibook created in Aquatic Toxicology course (A ECL 444/544X / TOX 444/544X) taught by Dr Boris Jovanovic at Iowa State University in Spring 2019. This course adopted open pedagogy practices that included the integration of a renewable assignment whereby students contributed to the creation of this Wikibook. The topics covered in this edition include: Bioindicators, Bio-transformations, Micro-plastic Pollution in the Aquatic Environment, and Aquatic Toxicity Tests. Future students taking the Aquatic Toxicology course will contribute to this collective work and help increase the coverage of the topics related to the interaction between anthropogenic chemicals and aquatic ecosystems.

Table of Contents [edit]

Fig. 15.3 "Perspectives of aquatic toxicology" introduction and table of contents

15.3 Open Pedagogy and Scaffolding

Open pedagogy is an experiential learning practice in which students take ownership in the acquisition of their own knowledge. Students in the three aforementioned higher education courses practiced open pedagogy through engaging in renewable assignments resulting in the creation of OER. Instructors in each of the above-described cases employed scaffolding as a teaching strategy to support students throughout the open pedagogy practices and creation of OER. The term *scaffolding* originated from the socioconstructivist model of learning and is grounded by the zone of proximal development where individuals are independent learners whose knowledge expands as they interact with more knowledgeable others (Vygotsky 1978). Applied scaffolds provide adequate information to support learners as they progress independently – in alignment with Vygotsky's zone of proximal development (Hogan and Pressley 1997). Instructors should recognize the need for extensive scaffolding throughout different assignment phases to assure the production of quality materials (Zimmerman 2002). The role of the instructor shifts from controlling content knowledge to mentoring the processing and facilitating of knowledge production. Thus, scaffolding strategy entices students to be actively involved in their own learning, which is an integral component of open pedagogy practices.

15.3.1 Renewable Assignment Phases and Scaffolds

Instructors incorporated renewable assignments into the coursework of three higher education courses. Renewable assignments are defined by their openness, extension beyond classroom borders, and ability to promote student interest, engagement, and performance (DeRosa and Robison 2017; Wiley and Hilton 2018). They illustrate the positive attributes of open pedagogy practices in course activities: added value, meaning, purpose, identity, competence, and autonomy (Wiley 2013). The value of renewable assignments is not restricted to their free availability online; they are also openly licensed where they can be reused and revised under 5 R permission. OER materials are released under creative commons licenses, which have various licenses to accommodate a number of different permissions (Kim 2007). Students need to become knowledgeable about open access licenses before beginning an assigned task; hence, all students enrolled in the courses discussed herein attended workshops that covered open pedagogy and placed their practices within the context of creating renewable assignments. Also, a librarian specialist explained open licenses and creative commons. Students used the creative commons attribution noncommercial share-alike license in the three cases. As such, the product of their open pedagogy practices is not only useful and available for others, but can also be built and improved upon as well.

Instructors provided detailed guidelines for each of the renewable assignments within the three contexts including: assignment objective, description, deliverables

Table 15.1 Renewable assignment phases with scaffolding examples and students' activities

Renewable assignment phases	Scaffolding example	Student activities
Topic identification	Help students identify authentic problems Help students identify their interests Provide feedback	Performed needs analysis to identify learners' needs to design the open course Identified trends and issues in learning environment design that improve learning Captured stimulating issues and perspectives in aquatic toxicology
Exploration	Provide exemplars of open resources Provide instructor and peer feedback	Collated information, images, etc. Prepared preliminary outline Shared with the class
Development	Provide feedback on multiple drafts	Developed materials
Communication	Provide constructive feedback from class, peers and instructor	Presented materials
Reflection and revision	Provide guiding questions	Discussions
Implementation	Final edits on content and open licenses Promote students' work	Publish open materials online

with due dates, and evaluation criteria. Instructors simplified the complex task completion process by dividing the renewable assignment into several phases and incorporating scaffolding strategies throughout all phases. These phases included: (1) topic identification, (2) exploration, (3) development, (4) communication, (5) reflection and revision, and (6) implementation. Table 15.1 illustrates renewable assignment phases aligned with scaffolding examples and student activities. These examples were selected to illustrate the kinds of instructional scaffolding available within an open renewable assignment.

15.3.1.1 Topic Identification

Students selected their topics of interests during the first phase. The instructors guided them by providing readings about current trends and issues in the field, and a selection of possible topics. For example, students creating the book series were provided readings related to trends and issues in learning environments. They were to discuss two highlighted trends that may improve learning in their field. The instructor subsequently provided them with a list of topics to choose for their book chapter. Students were also given the option of exploring a different topic if they had a preference not on the list.

15.3.1.2 Exploration

During the exploration phase, students researched various resources to compile and curate assignment materials, and collated all needed resource information including text, images, figures, diagrams, and video/audio material as well as checked relevant permissions. The instructors guided this phase by providing resources such as exemplars of open resources on similar topics. They also provided examples for each renewable assignment achieved through best practices. For instance, the following were given as examples: (a) “Pedagogical Practice” as an open course, (b) “An Open Education Reader” on PressBooks, and (c) “Human Physiology” on Wikibooks. Students prepared a preliminary outline for their first drafts at the end of this phase and shared them with their class peers and instructor for feedback.

15.3.1.3 Development

Students used content gathered from previous phases as a foundation for material development. Instructor scaffolding supported the development of quality student OER co-creation. Multiple drafts were required for feedback and revisions. Since the content that students were reusing/creating would be released under creative commons noncommercial share-alike license (CC-BY-NC-SA), students were required to obtain permissions to reuse and provide a proper attribution to the original source for all the materials that could not be released under that license.

15.3.1.4 Communication

Scaffolding was not only carried out between the instructor and students; it was incorporated within the entire class community. Students presented and shared their materials with the class. This process helped students receive constructive feedback from their instructor, class, and peers, as well as helped them self-evaluate their progress. Scaffolds guided students in a variety of ways such as challenging their thinking, considering alternatives, providing evidence to support their ideas, and evaluating their work.

15.3.1.5 Reflection and Revision

Reflection is an important component of learning especially when students are engaged in a complex process with several phases. Students engaged in meaningful discussions that facilitated feedback through questions and providing constructive feedback. They examined their materials and strategies and revised them based on the feedback they received from the class, their peers, and the instructor. The instructor scaffolded reflection by guiding students to reflect on their processes and assess their progress.

15.3.1.6 Implementation

After a period of reflection and material revision, students submitted their final work. Final student renewable assignment products were published openly on Canvas Commons, PressBooks, and Wikibooks platforms, and instructors promoted the students' work on various social media platforms.

15.3.2 Affordances and Challenges of Integrating Renewable Assignments

Renewable assignments provided students with an opportunity to collaborate for a shared goal, share responsibilities, explore ideas, debate, reflect, and thus take ownership of their learning. This process eliminated some of the imbalances in control and power in the classroom. Also, trust building through the act of scaffolding is key in open pedagogy practices, as it promotes learner motivation. Moreover, students received ongoing feedback in intervals which shaped their knowledge creation, moving from one phase to another with necessary edits until the end pieces fit together.

However, integrating renewable assignments and sharing them publicly generate challenges as well. For example, exposure and vulnerability may cause some students to resist the adoption of renewable assignments (Wiley 2013; Seraphin et al. 2018). To minimize these risks, instructors in the above three cases assured students that had an option to share their contributions anonymously.

15.4 Conclusions and Recommendations

The primary focus of the three cases described in this chapter was to explore the premises of open pedagogy and advance knowledge about open pedagogy integration into blended, online, and face-to-face learning environments in higher education. Practicing open pedagogy by creating renewable assignments has the potential to eliminate cost-related barriers of learning. The future sustainability of OER may be secured through widespread integration of renewable assignments with a potential to foster students' learning experience (Littlejohn and Pegler 2014). The three cases presented in this paper revealed that renewable assignments can empower learners to take ownership of their learning, build on prior open resources, and broaden the learning community. Scaffolding strategies were integral in all phases of the open pedagogy practices. Implementing and sharing similar practices in different contexts could create a dialogue among faculty and practitioners in higher education.

In order to facilitate the open pedagogy practices for future renewable assignments, we present the following design guidelines and recommendations.

Before engaging in open pedagogy practices, instructors should:

- Provide learners with a training on OER and open access literacy by explaining 5 R permissions, different copyrights, and licensing guidelines
- Model successful examples of open pedagogy practices
- Provide detailed guidelines that communicate assignment objectives, description, deliverables, and evaluation criteria

Instructors should divide the renewable assignment process into phases. Scaffolding takes place throughout all phases.

Phase 1 – Topic Identification: Learners identify the topic of interest.
Phase 2 – Exploration: Learners explore and research available resources about the topic to set a foundational base.
Phase 3 – Development: Learners develop their materials.
Phase 4 – Communication: Learners present their materials and share them with the class.
Phase 5 – Reflection and revision: Learners perform self-reflections and revise their materials accordingly.
Phase 6 – Implementation: Learners publish their materials after revisions based on self-reflections, peer feedback, and instructor feedback.

Recommendations for future practices include the following:

- Professional development programs should be designed to inform instructors about OER and open pedagogy practices integration in their classrooms.
- Implement open pedagogy practices in courses (start as one renewable assignment in each course).
- Establish scaffolding and provide multiple feedbacks throughout open pedagogy practices.
- Promote learner responsibility toward checking and reporting inaccuracies within content.

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Chapter 16
Overcoming Transactional Distances for Atypical Learners in Workplace M-Learning

Sushita Gokool-Ramdoo

16.1 Introduction

In the corporate setting, enterprises survive and thrive through keen knowledge of market trends. However, "because knowledge constantly makes itself obsolete, the pressure is on everyone to learn and continually apply new knowledge to problems and opportunities" (Schermerhorn and Chappell 2000, p. 15). Workers are therefore expected to anticipate and react on future work events. Since competent workers drive competent organizations, continuous professional development (CPD), competency-based training (CBT), or learning and development (L&D) are the different names describing initiatives aimed at addressing competency gaps. Competency gaps, which are the difference between a current and a desirable state of performance, are known to impact negatively on the efficiency and effectiveness of a company in terms of time, money, and reputation. CPD refers to a training activity that focuses on organizational effectiveness. L&D is slanted towards a planned and voluntary approach to continuous learning within a transparent organizational career path (Page-Tickell 2018). L&D is concerned with intrinsic employee motivation, progress, and engagement with learning. At the intersection of the two, CBT focuses on the workers' ability *perform* rather than to simply *know*.

Worker demographics, company mission and vision weigh in strongly during the selection of a training approach. TCL believes in training its workforce based on the specific competencies that ease its operations. This OAR responded to two major preoccupations of the TCL regarding one occupational group made up of 90 Drivers and Machine Operators (henceforth known as the Group). The company's preoccupations were the following:

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A. Marcus-Quinn, T. Hourigan (eds.), *Handbook for Online Learning Contexts: Digital, Mobile and Open*, https://doi.org/10.1007/978-3-030-67349-9_16

1. Without disrupting the tight construction schedules, what are the possible training solutions for 90 persons who are virtually illiterate, resistant to instructions, and carry a high reputational risk?
2. What learning content and training strategies can align the atypical learners' attitudes with the company mission and vision?

Given the number of construction sites and strict timelines, taking the workers away from worksites for any length of time for training purposes posed a challenge. Since they could not physically attend regular training sessions, the m-learning option of *distance education* (DE) was adopted as a solution to bring training to the leaners while simultaneously retaining their on-site availability. The second preoccupation was more complex. Most of the Drivers being functionally illiterate, they were seen as an atypical set of adult learners that required special arrangements to engage with learning. An audience-sensitive approach was required to bridge the psychological, pedagogical, spatial, and temporal transactional distances that the Group overtly experienced. After this introduction, this chapter presents the context for the successful implementation of an m-learning course. It engages with the literature to discuss the theoretical framework adopted to facilitate transfer of learning on a mobile device. It demonstrates how an innovative tablet loan scheme devised to provide access to digital learning solved many anticipated course delivery problems and enhanced the atypical adult learners' sense of self-worth and dignity. This chapter concludes that a solid theoretical base, knowledge of learner characteristics along with strong managerial commitment are pivotal to the success of workplace m-learning that enhances workers' dignity and align their attitudes with company mission and vision.

16.2 Context

TCL is the Mauritian subsidiary of a French-owned construction company. Its Senior Management is essentially French while 98% of its employee base is Mauritian. It participates in tender exercises to win contracts and operates within temporal and financial constraints to deliver undertakings. TCL is consistently concerned with the quality and timeliness of project execution, personnel safety and customer satisfaction to maintain its competitive edge.

Workforce capacity development is an ongoing concern to which a significant part of the company budget is devoted. Safety, which is central to TCL operations, is crystallized in the motto *Safety Attitude*. The *Safety Attitude* and technical innovations in matters of road construction are the main learning contents of its training programmes. At the time of training, TCL had a workforce of 604 collaborators, split into the following cadres: the Directors, the Senior Management, the Middle Management and the Companions. In Mauritius, English is the official language but the dominant language of operation is the Mauritian Creole, a pidgin with a heavy French slant. French is also widely used. Training is usually carried out in both

English and French, which are taught at school. As per company regulations, the Group had to undergo safety-related training, but had noticeable difficulties in using the language.

Given the quasi-impossibility of moving the Group away from work demands, m-learning was selected as the most accommodating training option. Three cohorts of 30 participants benefited from the CBT that ran from 2017 until the end of 2018. This 12-week course was designed to counter their literacy and digital skill deficiencies. A tablet loan scheme and their associated subscriber identification module (SIM) cards provided the 90 selected trainees with access to the cloud-based Moodle Learning Management System. Digital tablets and the SIM cards were purchased and distributed to the first 30 registrants. Upon course completion, the graduating cohort surrendered the tablets onto the upcoming cohort of 30. Since, as earlier mentioned, and later discussed, the atypical learners had literacy deficiencies, the following section discusses the theoretical notions that provided the authoritative basis upon which a successful course was constructed.

16.3 Literature Review: Theoretical Framework

Since competent workers are believed to drive competent organizations (Schermerhorn and Chappell 2000), workplaces have become gigantic classrooms whereby workers are required to undergo periodic re-skilling and upskilling activities to address competition, fast-changing technology, and organizational change (Smith and Drago 2004).

Increasingly, workplace m-learning is recognized as the cost-efficient and effective solution to bring learning to workers without compromising production deadlines. However, Traxler (2007) argues that there are scant theoretical conceptualizations and evaluation methodologies to guide the effectiveness of m-learning. “Some advocates of mobile learning define and conceptualize it in terms of devices and technologies; others … in terms of mobility” (Traxler 2007, p. 1). A theoretical approach enhances the scope and legitimacy of m-learning by conferring authority and credibility to both its conceptualization and evaluation and firmly anchors it as a *pedagogical* transaction. The ADDIEE model provided the theoretical framework that guided this OAR research and consequent course development. The use of theory enabled the accommodation of different perspectives and multicultural requirements typical to online DE (Nagel and Kotzé 2010). Theory connects this research “with the work of others, facilitate[s] coherent frameworks… [allows] deeper understanding of … actions and … [enables] us to transfer the experience gained in one context to new experiences and contexts” (Anderson 2008a, b, p. 33).

Each selected learning theory addresses specific learner and company requirements. The Transactional Distance Theory (TDT) (Moore 1993), the Community of Inquiry (Garrison et al. 2000), the five-stage model for online learning (Salmon 2011) and andragogy (Knowles 1980; Knowles et al. 1984) are woven together with

Saba's systems approach (2003) to align training requirements with corporate exigencies. The interaction of these theories with content development and implementation consolidates the success of DE delivery to even the most atypical of audiences. Using the ADDIEE model of programme planning to explicate the relevance of each theory, this review skims over research carried out on notions of workplace training, literacy, corporate teaching approaches, distance learning theories, and competency-based training to fully understand choices made in this OAR.

16.3.1 The ADDIEE Model of Programme Planning

The ADDIE model of programme planning (Fig. 16.1) is a universally accepted generic process used by instructional designers and adult education programme planners. Its five broad phases: Analyse, Design/Develop, Delivery, Implement and Evaluate (Moore and Kearsley 1996; Kurt 2017; Molenda 2003) guide decision-taking.

The move from ADDIE to ADDIE-E followed the inclusion of the notion of "Environment" referring to contextual and cultural elements (Gokool-Ramdoo 2008; see Fig. 16.1). Grafting Saba's systems approach (2003) onto the ADDIEE model provides an overarching perspective of the components inherent to a training event. Since there is no "single best media of online learning, nor is there a formulaic specification that dictates the type of interaction most conducive to learning …" (Anderson 2008a, b, p. 67), and given the unique learner characteristics, each stage of the ADDIEE model was pivotal in the identification of strategies responding to student and curriculum needs. The following discusses the decisions taken across the stages of the model ADDIEE:

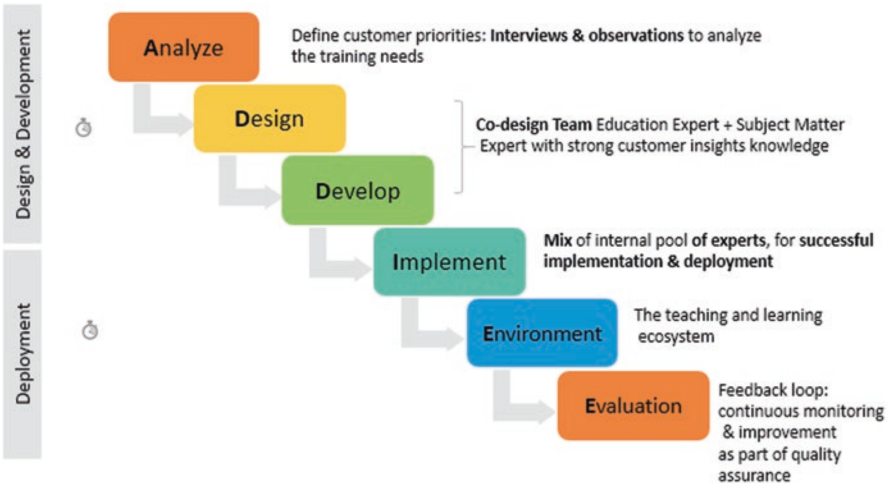


Fig. 16.1 Own work. The instructional design model, ADDIEE

(i) The selection of CBT over CPD and L&D based on learner characteristics
(ii) Choosing m-learning
(iii) Strategies for online delivery, backed by theories for distance and adult learning
(iv) Making the learning content easily digestible and attractive
(v) The required ecosystem learner support and course delivery
(vi) The research tools to gather OAR data on an ongoing basis for recalibration of practice

16.3.2 Workplace Learning: CPD, L&D, or CBT?

Workplace learning has developed as a field of practice and research over the past decade. Smith (2003) argues that workplaces provide a fertile opportunity for learners to appropriate knowledge that connects theory to practice in a realistic and efficient way. Various names have sought to define this activity with clarity. CPD has brought attention to its lifelong nature; L&D has highlighted the importance of intrinsic motivation for professional development, while CBT has narrowed the focus on the competency and performance aspects required to make a worker fit for a job.

CPD is a complex and multifaceted notion that is concerned with practices aimed at workers' development beyond that derived from their initial training (Smith 2003). Effective participation in contemporary, technology-based, knowledge society requires continuously learning new things to adapt to ever-changing situations. Typically, CPD is a voluntary exercise, often associated with certain professional bodies, for instance, the legal or medical where membership or certification can be mandatory for practicing the profession. To be able to reflect on and take decisions for further training, worker's prior formal training is a prerequisite.

In the L&D trend, training aims at "building the capability of [the] organization" (Page-Tickell 2018, p. 5) while focusing on employee growth and future performance, rather than an immediate role. L&D is concerned with retaining the best talents to maintain a competitive edge. It requires a continuous approach to learning within an established and transparent career path. L&D initiatives relies on the workers' intrinsic motivation for learning and self-improvement. Companies facilitate L&D initiatives by creating a career map for employees who typically and voluntarily organize their development around the company career blueprint.

Competency-based training (CBT) is a small subset of the bigger L&D framework. The National Volunteer Skills Centre of Australia defines it as the "structured approach to training and assessment that is directed toward achieving specific outcomes" (NVSC 2003, p. 8). Competency-based training focuses on "performing" rather than just "knowing" (NVSC 2003). Decisions for CBT are taken based on what a person is required to do (performance), under what conditions it is to be done (environment) and how well it is to be done (standards). It refers to a set of *attitudes, knowledge and skills* that the company views as prerequisites to carry out certain tasks.

Within the workplace, CPD, L&D, and CBT are all necessary to foster the twenty-first-century competencies, which in turn are firmly embedded in the UN Sustainable Development Goals [SDGs], (UN 2015; UNESCO 2017). The latter articulate requirements that will allow for citizens' effective and harmonized participation in their communities. Twenty-first-century competencies include aspects such as: systems thinking, problem-solving, autonomy, wise decision-taking, the ability to anticipate and critically act on future events, strategic and inter-personal competencies, communication as well as media and ICT skills (Sterling et al. 2017; Rothwell and Graber 2010). A successful CBT has to simultaneously transfer corporate objectives as learning outcomes, twenty-first-century competencies and achieve learner satisfaction. In recognition of the importance of this approach, the Times Higher Education even has developed a new ranking scale related to sustainability or twenty-first-century competencies that are associated with UN sustainable development goals (Bothwell 2018; UN 2015). With distance education, CBT becomes potentially within the reach of every worker.

16.3.3 M-Learning in the Corporate Sector

Distance education meets a series of corporate and learner requirements. Among its various options, m-learning is increasingly attractive in the corporate setting. M-learning "currently exploits both handheld computers and mobile telephones and other devices that draw on the same set of functionalities" (Traxler 2007, p. 3). Innovations in programme applications and social software using Web 2.0 technologies, its lower costs, instant accessibility to current information, mobility and the intimacy that is developed with the learner, are appealing (Park 2011). However, phone-based m-learning has several limitations. Smart phones that can sport learning applications are expensive and have limited usability as opposed to another mobile device – the digital tablet. Despite the availability of Moodle as a telephone application, and taking in consideration the age of the learners, (mean age of 45) this particular m-learning initiative was carried out on a tablet to avoid eyestrain and for a greater level of user comfort. The sections hereunder discuss the theoretical notions employed to construct effective learning.

16.3.3.1 Knowles' Andragogy

Despite the controversy surrounding them, Knowles' (1980), Knowles' et al. (1984) thinking and assumptions about adult learning have helped delineate the didactic approach. Knowles approached the adult learner as somebody in charge of personal and professional responsibilities. He argued that the adult self-concept should be woven in the learning-teaching strategies. Despite criticism for want of conceptual clarity (e.g. see Reischmann 2004), assumptions around "andragogy" (Knowles 1980; Knowles et al. 1984) remain valid because they shed light on the special

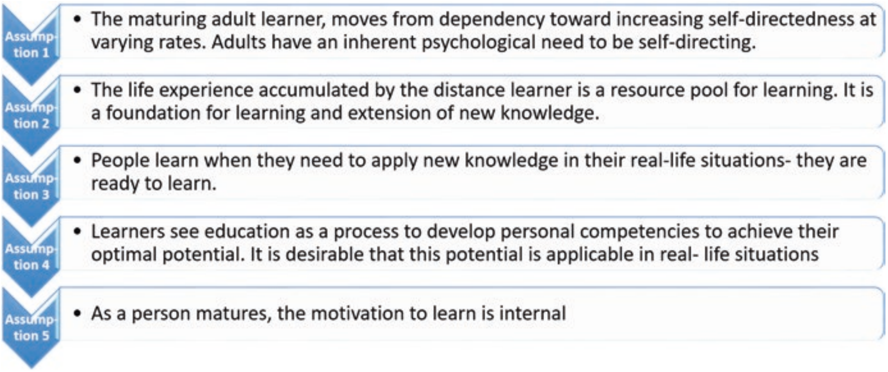


Fig. 16.2 Own work. (Adapted from Knowles' andragogical assumptions Knowles et al. 1984)

requirements and circumstances of the adult learner. More explicitly, given his multiple personal and professional commitments, the adult learner has an internal source of tension and is engaged in a continuous transaction with his/her external and internal environment (Garrison 1985). For the purposes of this chapter, *andragogy* is taken as the special circumstances that guide an adult in an educational endeavour. The following assumptions (Fig. 16.2) are the axes around which the online programme was developed:

Based on the above assumptions, customized strategies were required to enable the mature learners build confidence and autonomy to take work-related decisions and anticipate unknown work events. The teaching strategies emerging from the TDT were useful in reducing the transactional distances, as now discussed.

16.3.3.2 Moore's TDT

The Transactional distance theory (TDT) is an overarching DE theory that guides practice. Systemic in approach, it provides a comprehensive perspective of all teaching and learning transactions as well as the interplay between the numerous factors beyond the teacher and the learner (Moore and Kearsley 1996; Gokool-Ramdoo 2008, 2011). At the core of any teaching event, there are three basic types of interactions: learner–content/learner–instructor and learner–learner (Moore 1989). Other variables grafted onto this core are, among others, technology, time, space, and finances. Breakdowns in this interaction lead to "distances" in DE. The TDT proposes that distance is a pedagogical [and psychological] phenomenon: it is a distance of understandings and perceptions that has to be overcome by teachers, learners, and educational organizations if effective learning is to occur. Given their earlier mentioned atypical characteristics, several distances affect the audience of this project: psychological [learning anxiety], spatial [continuous need to be on-site], temporal [personal obligations], and technological [inability to use technology for learning]. The transactional nature of contemporary DE operates around "struc-

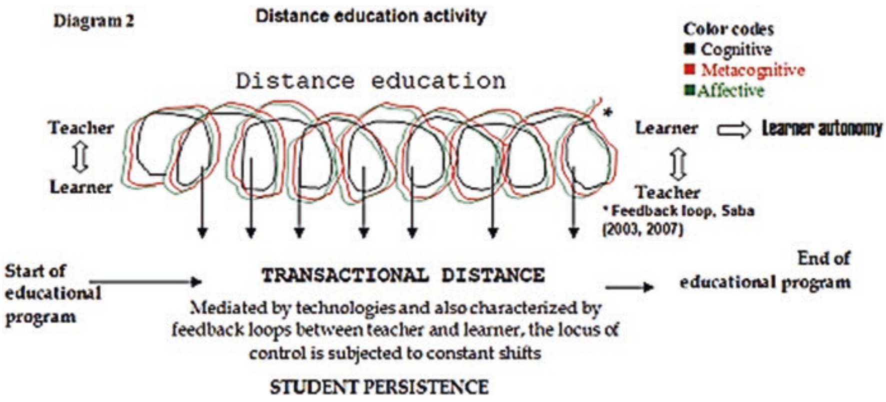


Fig. 16.3 Transactional distance theory (Gokool-Ramdoo 2008). (Reproduced with permission from IRRODL)

ture", "dialogue" and an additional element, "learner autonomy" (Moore and Kearsley 1996, 2005, 2012). "Dialogue" focuses attention on the interplay of words, actions, and ideas in interactions between teachers and learners during the exchange of cognitive information. "Structure" refers to instructional design, activities, and assignments. Dialogue and structure are both determined by the educational philosophy of the teaching organization, the teachers themselves, the academic level and maturity of the learners, the nature of the content, and especially the communications media employed. The aim of balancing structure and dialogue through continuous feedback loops (Fig. 16.3) is to engage the learner in a meaningful learning enterprise that makes sense for him and his environment.

Interactions occur in the "feedback loops" that circulate pedagogical information from the teacher to the learner so that at the end of the course, the learner appropriates the learning content and becomes responsible for his/her learning. The pedagogical information is broken down into cognitive, metacognitive, and affective competencies (Fig. 16.3). A successful course aims at motivating and engaging the learner into discovering the learning content, reflect on it and do activities that facilitate transfer of learning. Especially relevant for the atypical distance learner, Keegan (1993) proposes that an effective way to do this is to re-create the classroom environment that elicits the learner's intrinsic will to learn. To bridge the pedagogical transactional distances, two other theoretical notions are introduced.

16.3.3.3 The Community of Inquiry

The Community of Inquiry (CoI) provides a relevant framework to recreate the classroom environment (Garrison et al. 2001). The CoI represents a process of creating a deep and meaningful learning experience through the development of three interdependent elements – social, cognitive, and teaching presence. Social presence refers to the participants' ability to identify with, and be part of the community in which they find themselves. Towards reducing psychological transactional distance, the community provides opportunities for the learners to feel safe, trust their peers, communicate and develop personal relationships (Akyol et al. 2009). Teaching presence is the design, facilitation, and direction of the social and cognitive processes to achieve the relevant learning outcomes. These results must be personally meaningful, pedagogically valid and demonstrate a growing ability of the learner to manage his learning and integrate it effectively in his daily life. Cognitive presence is the extent to which learners are able to construct and confirm meaning through sustained reflection and discourse (Anderson et al. 2001). Advantageously, while the COI was expansive enough to accommodate different learning styles of the disparate learners (Ally 2008, p. 22), Salmon's e-learning model facilitated learning at a micro level.

16.3.3.4 Salmon Five-Stage Online Learning Model

Effective training is usually designed to circumvent the Ebbinghaus forgetting curve, which refers to the pace at which newly acquired knowledge is forgotten without attempt to retain it through adequate exposure or use (Murre and Dros 2015). Salmon's online or e-learning model usefully guides the breaking down of the learning content into digestible micro chunks that facilitate retention. Microlearning is concerned with microcontents or micromedia (media resources in micro size). It deals with relatively small learning units and short-term educational activities (Hug 2006). Salmon argues that for online learners to successfully remember and transfer learning, it has to be adapted to the participants' level and supported through a structured developmental process. Figure 16.4 atomizes the learning processes on an online LMS.

Each learning unit was minutely deconstructed and make assimilable. Through a series of easily digestible, smaller learning units or e[lectronic]-activities, or microlearning activities, and information exchange, this model has made it possible to support learner progress and ensure social, cognitive, and teaching presence all through.

16.4 Research Methodology and Methods

Since the CPD aimed at transformative change in the organization, OAR was deemed as the appropriate research methodology. Grounded in practical action, action research (AR) aims at solving an immediate problem situation while carefully informing theory (Baskerville 1999 p. 3). In AR, the "researcher is a facilitator for problem solving" (Merriam and Simpson 2000, p. 122).

AR is performed collaboratively and enhances the competencies of the respective actors (Merriam and Simpson 2000). With people participating in decisions

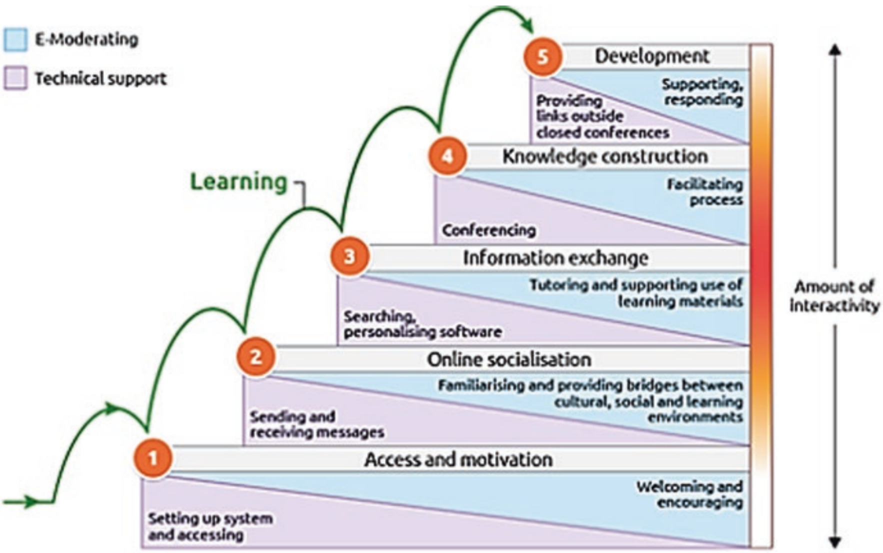


Fig. 16.4 The 5 stage e-learning model (Salmon 2011). (Reproduced with permission from the author)

affecting them, they are more likely to accept change. This research design is evolutive rather than predetermined. It involves a spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of the action (Baskerville 1999). OAR "simultaneously assists in practical problem solving and expands scientific knowledge involving …highly interpretive assumptions … about observation" and researcher intervention in the problem setting (Baskerville 1999, p. 7).

AR implies an interpretivist viewpoint of research enquiry that accommodates the observer's intrusion upon the observation (Merriam and Simpson 2000). Figure 16.5 shows how the action research cycle can be easily transposed onto the ADDIEE model and thus be conducive for researcher and participant self-reflection.

16.4.1 Sample

Typical to AR, and as part of convenience sampling, the population of interest "was part of the natural flow of human activity" (Merriam and Simpson 2000, p. 123). Essentially, the Group's formal education, negative attitudes to training and known literacy deficits were considered as essential variables upon which the CBT-introduced change would be observed with their informed consent. The mean age of the 90 participants ($N = 90$) was 45. Out of the 90 learners, five ($N = 5$) did not

Fig. 16.5 Own work. Action research cycle transposed onto ADDIEE. (Adapted from Baskerville 1999)

complete the programme: two (*N* = 2) were anticipating retirement and opted out; one (*N* = 1) was anxious about technology; two (*N* = 2) others had heavy family commitments. Out of the three cohorts, 85 (*N* = 85) learners completed the programme and became the research subjects.

16.4.2 Research Tools

The following quantitative and qualitative research tools provided a rich data mix: observation, structured interviews, and questionnaires. The researcher, course writers, and the learners all participated in data generation. To each, it was an incursion into the unknown. *Unstructured and informal observation* required systematically recording events during the face-to-face sessions. Empirical data were captured during telephone support sessions through *structured interviews* and through a *summative evaluation questionnaire* that was implemented after the final examination to each cohort. Informal data were recorded from the learners' forum where they were encouraged to communicate any job-related grievance. *Evaluation questionnaires* were administered at the end of the second examination. Finally, *examination performance* provided extra insights into learner progress and attitudinal change. Thus, the empirical data that were obtained across the three cohorts strengthened the conclusions of this chapter.

16.5 Emerging Results

The theoretical mix used to decrease transactional distances provides guidance to other practitioners. It also addresses concerns such as the goals of workplace training, the trainee profile, challenges faced by the workplace learner, guidance to those challenges, and learner support (Smith and Drago 2004, p. 193). The demonstrable success of this course lies in the level of student satisfaction achieved in the different areas investigated. Such areas include: the appropriateness of digital device used, the relevance of learning content to workers' profession, teaching presence and student support, transfer of learning, and the leap from literacy deficiency to digital literacy. The data hereunder were collected at all the stages of the ADDIEE model.

16.5.1 Analyse

This phase of the ADDIEE enabled the profiling of the learners yielding information about their characteristics, context, and culture. At the lowest rung of the operational ladder and carrying varying levels of literacy deficit, the Group represented a highly at-risk audience that required scaffolding to enable their acquisition of work-related competencies. Building complex skills upon a weak foundation of basic skills and earlier negative learning experiences could compromise the acquisition and retention of new knowledge.

Documentary evidence gathered from their job application forms, subsequent performance appraisal forms and anecdotal evidence reported by their Supervisors confirmed that *with the exception of two learners*, the Group carried mild to severe functional illiteracy. UNESCO defines illiteracy as a situation where a person cannot "with understanding read and write a short simple statement on his everyday life" (UNESCO 1978, p. 183; UNESCO 2005). Functional illiteracy is that condition whereby a person "cannot engage in all those activities in which literacy is required for effective functioning of his community and also [cannot use] reading, writing, and calculation for his own and the community's development" (Vagvolgyi et al. 2016).

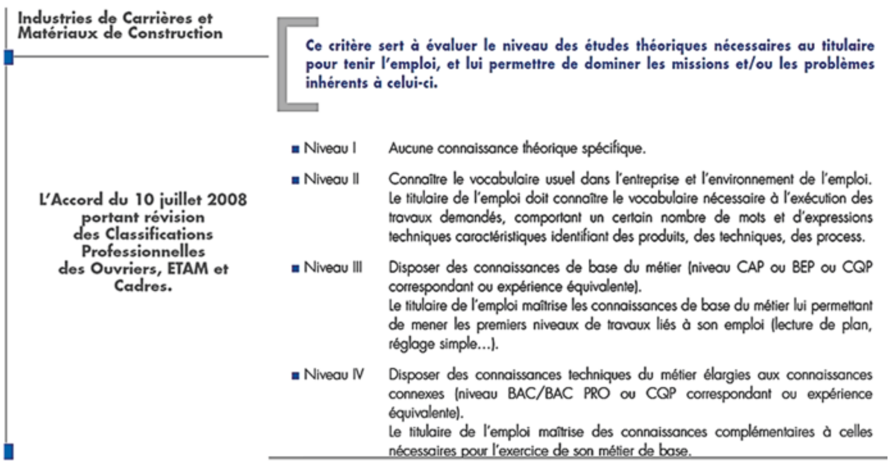
Besides illiteracy, the group's documented deficiency in communication skills led to several misunderstandings with the Management. Resistance to instructions entailed repetition of both the instructions and the associated task at increasing costs to offset time thus wasted. The Group's attitude towards their tasks was often negligent and required police intervention because of road rage, use of phone during driving, and road or site-based accidents. Their high visibility as they drove the brightly coloured corporate orange machines bearing TCL logotypes increased the company's reputational risk especially in the event of misbehaviour or accident. Taking the above into consideration, the learning content started taking shape.

16.5.2 Design/Develop

In the Design/Develop phases, the learning content was mapped out using existing regulations and a dedicated PowerPoint Presentation. Since TCL is part of a French multinational group, the competency regulations listed in the *Accord du 10 Juillet portant revision des classifications Professionnelles des Ouvriers, ETAM et Cadres* (Gouvernement Français 2008) provided the foundation for the learning content. The regulatory document lists the requirements for a worker to perform his duties optimally. These include aspects such as the use of specialized technical vocabulary as well as the ability to take job-related responsibilities (Fig. 16.6).

The above document is further articulated within the company's internal Policy for Road Safety (Fig. 16.7) and accompanying *Driver Competency Assessment System*. Clause 6 hereunder (see Fig. 16.7) describes management commitment to set up training events to continuously train and upskill the Group to guarantee a high level of performance related to road safety. It also undertakes to support them in reinforcing the driving standards according to an established benchmark.

Training is thus connected to TCL's core business and associated health, safety, communication, and technical concerns. Training on the *Safety Attitude* was mandatory for newcomers. Informal interview data with the course writers who worked closely with the Group indicated that the learners rapidly forgot what they learnt despite occasional refresher courses. The shortness of exposure to the learning content caused demonstrable low retention. An initial *1-hour* training content was repurposed into a *12-week* competency-based m-learning course. A committed Health and Safety Manager had developed the original content. The re-purposing benefited from the additional support of the Industrial Manager and colleagues from the ICT department. They ensured that the course material was an exact match to the

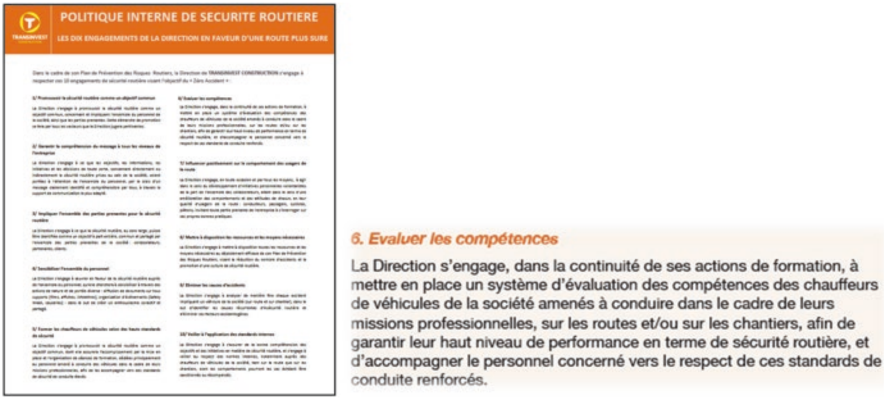

Industries de Carrières et Matériaux de Construction

Ce critère sert à évaluer le niveau des études théoriques nécessaires au titulaire pour tenir l'emploi, et lui permettre de dominer les missions et/ou les problèmes inhérents à celui-ci.

L'Accord du 10 juillet 2008 portant révision des Classifications Professionnelles des Ouvriers, ETAM et Cadres.

- Niveau I — Aucune connaissance théorique spécifique.
- Niveau II — Connaître le vocabulaire usuel dans l'entreprise et l'environnement de l'emploi. Le titulaire de l'emploi doit connaître le vocabulaire nécessaire à l'exécution des travaux demandés, comportant un certain nombre de mots et d'expressions techniques caractéristiques identifiant des produits, des techniques, des process.
- Niveau III — Disposer des connaissances de base du métier (niveau CAP ou BEP ou CQP correspondant ou expérience équivalente). Le titulaire de l'emploi maîtrise les connaissances de base du métier lui permettant de mener les premiers niveaux de travaux liés à son emploi (lecture de plan, réglage simple…).
- Niveau IV — Disposer des connaissances techniques du métier élargies aux connaissances connexes (niveau BAC/BAC PRO ou CQP correspondant ou expérience équivalente). Le titulaire de l'emploi maîtrise des connaissances complémentaires à celles nécessaires pour l'exercice de son métier de base.

Fig. 16.6 Regulations for CBT in French construction companies



POLITIQUE INTERNE DE SECURITE ROUTIERE

LES DIX ENGAGEMENTS DE LA DIRECTION EN FAVEUR D'UNE ROUTE PLUS SURE

6. Evaluer les compétences

La Direction s'engage, dans la continuité de ses actions de formation, à mettre en place un système d'évaluation des compétences des chauffeurs de véhicules de la société amenés à conduire dans le cadre de leurs missions professionnelles, sur les routes et/ou sur les chantiers, afin de garantir leur haut niveau de performance en terme de sécurité routière, et d'accompagner le personnel concerné vers le respect de ces standards de conduite renforcés.

Fig. 16.7 Company policy on road safety

learners' needs. The repurposed course increased learners' exposure and practice with the learning content (Murre and Dros 2015) which revolved around the following:

(i) *Cognitive competencies*: deepening learner knowledge of company policies, operating procedures, pertinent laws and regulations, technical skills, and ability to discern hazardous situations and vehicle weaknesses on the road and construction sites
(ii) *Metacognitive competencies*: mastering the ability to explain how the *human, vehicular and environmental* factors intersect to cause accidents and overcome these ability to anticipate and to autonomously act responsibly upon unknown events
(iii) *Affective competencies*: understanding factors contributing to learners' physical well-being, and deepen their loyalty to company objectives
(iv) *Communication competencies*: using digital devices to communicate with their superiors

In planning the course layout, different learning styles – that is the preferred way to absorb, process, understand, and retain information – were accommodated. These included the auditory (listening), kinaesthetic (sense of touch), visual (use of images) and linguistic (verbal). One person can be an auditory learner in one situation and kinaesthetic in another. Since it is difficult to predict individual responses, a mix of learning styles was anticipated. Technology and plug-ins inherent to the Learner Management System, Moodle 3.7, facilitated learning in each of the intelligence areas and accommodated individual learning styles (Drago and Wagner 2004; Strother and Alford 2003; Garrison et al. 2001). An electronic learning manual, the E-book, carried two volumes related to (a) driving generally and (b) driving behaviours on sites. Each volume was spread over six training weeks. To illustrate the content, relevant video clips bearing the Creative Commons licence were used with relevant attributions. An electronic book and the course content were written in English. However, given the literacy challenges, the whole content was translated to

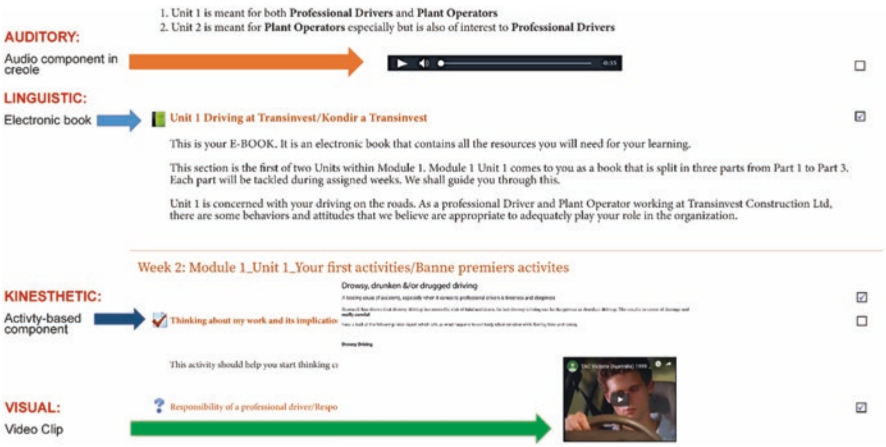


Fig. 16.8 Screenshot of a course page with the different learning styles

the lingua franca, the Mauritian creole. This deliberate move demonstrably reduced psychological transactional distances and immediately put the learners at ease. Figure 16.8 shows how each learning style was accommodated into the course with each electronic page carrying audio-visual and linguistic components to engage with the learners and make them feel comfortable.

To relieve learner anxiety and to circumvent reading given their literacy deficiencies, an audio component was interspersed with the written and visual content. The teacher's voice reading out the text in *creole* throughout the course, using the tutors' voices enforced learners' trust and ease with this new assignment. Questions and answers were all read out in Creole. Once the learning content was outlined, space was made for Management to show an online presence and commitment to the training (Fig. 16.9).

This presence was a deliberate icebreaker: the welcome message connected the learners to the French Director who personally welcomed and motivated the learners in the lingua franca. This initiative positively touched those at the lowest rung of the operational hierarchy and prompted trust as well as a sense of belonging.

16.5.3 Delivery

Despite the fact that cloud-based Moodle was also available as a mobile application, the tablet proved to be a far superior ally for course delivery. The wider screen display facilitated interaction across the LMS with clearer texts and images. Flexibly, its asynchronous nature allowed learners to "walk into the classroom" at their convenience, away from the demands of the construction sites. The range of integrated media and learning resources allowed students to choose what suited them best, while effectively reducing transactional distances by improving dialogue

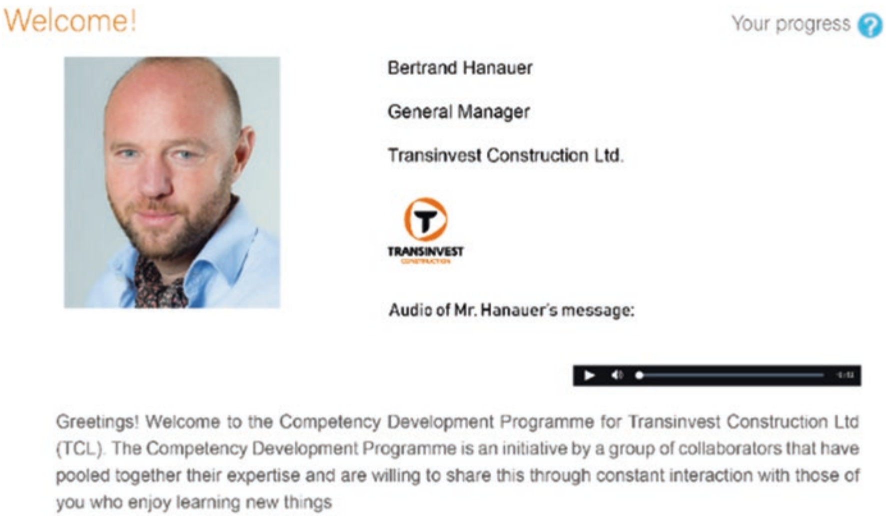


Fig. 16.9 Management presence

Salmon's 5-stages	Objective	Knowles' Assumptions	Objective	How this was addressed on the LMS
Step 1 Access & Motivation	• Familiarising learners with the online setting, use of course software relevant instructional activities • Addressing the technical issues and the underlying feelings and emotions • Decreasing psychological transactional distance (Moore, 1993)	1. Self-Concept	Create learning experiences that promote autonomy. Explain certain commands, functions, operations, + use learner feedback	-Strategies to build learner confidence with technology and erase negative past experiences.
Step 2 Online Socialisation:	• Creating online community through short activities or micro-learning that cultivate trust during student exchange • E-moderators give social presence and support (Akyol *et al*, 2009)	2.Adult Learner Experience	Include a wide range of theories to appeal to varied experience levels and backgrounds.	-Different learning styles tapping into their reservoir of experience as adult learners
Step 3 Information Exchange:	Students processing information and become more proactive in their learning.	3.Readiness to Learn	Utilize online collaboration tools to tie learning to social development and communication.	-Motivating learners to challenge themselves --A forum enables discussion at Week 7 -Providing a safe and comfortable learning environment -Increase sense of internet efficacy.
Step 4 Knowledge Construction:	• Activities focusing on higher order thinking skills and learner autonomy (Moore,1993).	4. Orientation to Learning	Learning material built around adult learner's experience (Knowles, 1984)	Emphasize how the subject matter is going to solve problems that the adult learner regularly encounters.
Step 5 Development:	Acquisition of new metacognitive skill whereby learners learn to monitor and evaluate their thinking: learners take ownership and responsibility of their learning experiences.	5. Motivation to Learn	There must be a valid reason behind every course, module or educational activity.	Learners know how this course will positively affect their professional performance

Fig. 16.10 The interaction between the selected theoretical considerations

among all partners. Moodle provided a space for interactive and critical-reflective activities. However, and especially with an audience fraught with known challenges, special care had to be paid to breaking down the bulk of the learning content into easily digestible morsels. Figure 16.10 demonstrates how Salmon's five-stage model interacted with Knowles' notions of andragogy to reduce transactional distances through micro-learning activities. The above-mentioned frameworks inform and enrich one another. Together, they provide a stronger foundation for teacher intervention and learner engagement.

During programme delivery, Salmon's five-stage model is interwoven with Knowles' assumptions. For instance, at Step 2, learner experience is carefully built into the learning activities. The column entitled, *How this was addressed on the LMS*, demonstrates how all the theoretical considerations converged towards effectively motivating the learners transfer their learning into their professional activities.

16.5.4 Implement

During the implementation phase, with the programme planned for 12 weeks, examinations were held after each series of 6 weeks. Informal interviews and observations provided information on the level of student satisfaction. At Week 0, an induction session set the learning scene. First, digital tablets and their associated SIM cards were purchased and distributed to the first 30 registrants for the duration of the course. To ensure that they could use the device, the learners were trained on using the learning platform to make them comfortable with the technology and learning content. Whilst the programme was otherwise fully online, face-to-face meetings were scheduled for Weeks 0, which was the induction week and Week 5 [and Week 11]. Weeks 6 and 12 were revision sessions where learners were given practice activities, support to assuage anxiety and motivation for the examinations. They were encouraged to call their tutors in cases of difficulty. The examinations were held at Weeks E1 & E2 respectively. Figure 16.11 describes the programme timeline and activities.

Student progress was monitored on the Moodle Learning Analytics. Any sign of weakness or fatigue was promptly investigated through scheduled telephone-based support exercises. The forum was presented as an optional tool for communication among the learners to promote higher order thinking through online chats (Stein et al. 2013). It was also used as another instrument to measure learner progress and autonomy. The comments from the bolder learners, who were less worried about

Week 0	Weeks 1&7	Weeks 2&8	Weeks 3&9		Weeks 4&10	Weeks 5&11	Weeks 6& 12	Weeks E1 &E2
Induction	Independent learning		Learner support		Independe nt Learning	Support session	Indep-endent learning	Exami-nations
Introduction : content, E-book, video clips, e-vities, forum use •Distribution of tablet •Navigation tips •Motivation and Encouragement	Tutor	Learner	Tutor	Learner	Learner obser-vation	Face to face session-recalibrating interventions and solving problems	Exam preparat ion	Held face-to-face with audio support and paper-based responses
	Monitoring on Learning Analytics Starts observing learner	Getting to know the learning environment Starts on e-vities	Tele-phone support	Describes and solves problems				

Fig. 16.11 Programme timeline and activities

publicly exposing their grievances, even informed management decisions. At Week E1 (and Week E2), examinations were held. The examination was based on the following format: learners listened to a voice recording of the questions listed on the questionnaire that they were given. The right answer to the multiple-choice questions was shaded on the answer sheet. At Week E2, after the examination, they filled in a summative evaluation questionnaire, data from which also informs this chapter [see Appendix 1].

16.5.5 Environment

This project validates Kolb & Fry's assumption (1975, p. 55) that "any theory of learning must deal with person-environment interaction […] to be useful". Indeed, the theoretical considerations adopted in this chapter have led to a unique ecosystem of virtual learning and its transformative environment. In Mauritius, it is felt that face-to-face sessions are the culturally expected norms: online learning is notoriously a difficult approach to adopt especially with an older audience (Gokool-Ramdoo 2011). This challenged audience *was* an exception: 100% of the 85 respondents claimed that the online learning experience was satisfactory; 5% reported that the experience was perfect, while 75% would have wished for more contact sessions. In fact, the learners were surprised at their own autonomy and digital ease. This is clearly due to the theoretical considerations that influenced the learning environment. The relative anonymity and non-judgemental nature of the ecosystem provided safety, security, and comfort for the unfolding of the learner's potential. The ecosystem aimed constantly at enhancing "learner comfort and competence with the intervening technology, and providing safe environments for learners to increase their sense of internet efficacy", Anderson (Anderson 2008a, b, p. 36). Engineered social, teaching, and cognitive presence achieved the learner's planned transformation from apprehension to autonomy. The tutors' commitment and teaching presence played a pivotal role in reducing the psychological distances and in achieving these outstanding results. Not only did they own the learning content which carried company requirements, but as shown by the evaluation data, their dedication in supporting the learners led to success.

16.5.6 Evaluation

Data collected throughout programme development contributed to lessons learnt. The results of the formal evaluation survey questionnaire that was administered after the E2 examination to the 85 participants are published hereunder (Fig. 16.12).

Learner satisfaction was overall overwhelmingly positive. With regard to cognitive competencies, 100% respondents claimed that they appreciated both audio and

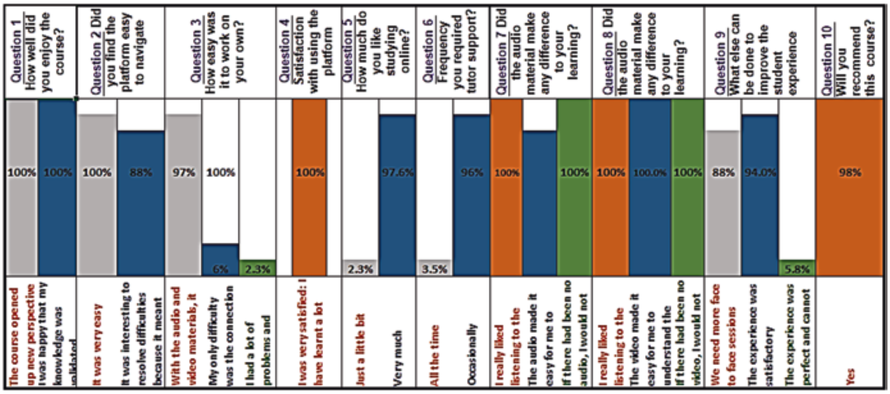


Fig. 16.12 Learner satisfaction

video materials "because they showed [my] work in the right perspective". They also agreed on the fact that without the audio–visual support materials, they "would not have been able to do the course". On the other hand, achievement of *learner autonomy* was confirmed since 82% reported that they required support only occasionally; 97% claimed that the audio-visual materials significantly facilitated their learning. Finally, 100% confirmed that they were fully satisfied with the course and had thoroughly enjoyed learning to use a tablet and a learning platform: the course had opened up new perspectives for them. Therefore, the learners developed the set of knowledge, metacognition, and attitudes required by the company. Additionally, they also developed communication competencies in line with the twenty-first-century requirements. However, beyond the planned evaluation questions, it was the unsolicited response regarding how the learners' dignity and confidence were restored that was most humbling, satisfying to the teachers. Their gratitude to Management for the overt trust placed in them by loaning them a tablet made them overcome usual learner tensions arising from personal and professional obligations. Post-training, their supervisors informally reported a new sense of calmness, purpose and responsibility among the Group, thereby confirming successful transfer of learning.

16.6 Lessons Learnt

Learner satisfaction achieved in this m-learning course confirms that a theoretical foundation facilitates the use of mobile technologies for effective workplace learning. Theoretically engineered m-learning training courses have greater chances at supporting the atypical learner's planned transformation from apprehension to autonomy. Additionally, they can demonstrably lower the risks of negative course performance.

Internally developed courses carry a unique house style that increased their relevance to company requirements. Learners tend to identify with the learning content that is most relevant to their professional roles and feel comforted if they know the instructor. Internal talents need to be tapped for course development and empathetic staff should be trained to deliver internally developed programmes. Rewards for both tutors and learners can be monetary or in terms of performance points leading to rewards and/or career advancement.

This OAR has shown how workplace learning has more chances of being successful when Management is fully committed. This Management had the foresight to provide access to learning to the Group through the innovative tablet loan scheme. Management presence is an important source of psychological support and enhances workers' sense of belonging to the company, but this extra mile is seen to foster pride, dignity, and loyalty.

16.7 Conclusion

This chapter has provided a solid theoretical foundation for mobile learning in the corporate sector and guidance on developing an m-learning course for an atypical audience. Aligned with the principles of OAR, and drawing from appropriate theoretical considerations, the ADDIEE model of programme planning has correctly guided course development and implementation. Empirical data from this OAR confirm that while theoretical conceptualizations are important to guide course effectiveness, these must be adapted to audience needs. A learner-responsive m-learning course can make the workplace a place where dignity can be restored and bring about. By valuing its employees and trusting them with an electronic tablet, the company has (i) scaffolded their leap from illiteracy to digital literacy, (ii) successfully enabled the acquisition of work-related twenty-first-century competencies, (iii) enabled participation from an invisible audience, and (iv) powered learner autonomy.

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Chapter 17
The Professional Development of Teachers Using Tablets in Bilingual Primary Classrooms

Charles L. Mifsud

17.1 Introduction

Schools and teachers face several challenges that relate to the embedding of digital tools in educational systems which historically privilege print. Oftentimes, the mandated literacy curriculum lags behind new literacy research and there may be an exclusive emphasis on print literacy in the school. Teachers should not abandon these traditional literacy practices, but work to use technology with a similarly rigorous pedagogical framework (NAEYC and FRC 2012). Without training, however, teachers may have trouble understanding how to incorporate technology in a way that proves consistent with learning theories (Falloon 2013). Further, teachers may be constrained from embedding new forms of digital textual practices (Mills 2016), and experience resistance to change.

Some national education systems are embracing technology, with varying degrees of success. They see schools as the main agents to prepare their children for the challenges of the future. There is considerable investment in bringing hardware and software to schools, teachers and students throughout Europe. The first OECD PISA assessment of digital skills, however, revealed that schools may not be prepared to take advantage of the potential of technology in the classroom and give every student the skills they need in today's connected world (OECD 2015). Still, the importance of ensuring that children have acquired the basic skills of reading and writing and of navigating the digital landscape makes finding effective means of integrating technology into the curriculum critical.

For integration of technology in the classroom to be effective, there needs to be an emphasis on situated, ongoing professional development, changes to the curriculum and assessment, and a shift to improving teaching and learning through the use of innovative pedagogical techniques that make the best use of appropriate

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technological tools (Eady and Lockyer 2013; Moeller and Reitzes 2011). Such tools can help diagnose and address individual student learning needs and help students to actively and independently organise their learning.

17.1.1 Literature Review

The integration of digital technologies into literacy instruction.

Many literacy teachers struggle to effectively integrate and teach both traditional and new literacy skills within a confined curriculum and a limited timeframe (Hutchison and Reinking 2011). According to Hutchison and Woodward (2014), the challenges for teachers when integrating digital technologies into literacy instruction include: inadequate technological knowledge, expectations of students' ease with technology, inappropriate expectations for assignments, and limited conceptions of the purposes of technology. Teachers, therefore, require a clear instructional planning framework to integrate tablets into their teaching. They also must draw on their technological, pedagogical, and content knowledge (TPACK) to integrate technology into their classroom instruction (Mishra and Koehler 2006).

Hutchison and Woodward (2014) devised the Technology Integration Planning Cycle (TIPC) (Beschorner et al. 2018) as a guide to help teachers to integrate digital technology into literacy instruction in meaningful ways. Teachers used TIPC to plan instruction with explicit instructional goals related to course, grade-level, and state and national standards. It is a reflective cycle and the instructional objectives can be revisited according to the affordances of the digital tool. Similarly, Northrop and Killeen (2013) presented a framework for integrating tablets into classrooms to teach early literacy skills in an effective and engaging manner. They modified and applied the instructional framework of gradual release of responsibility (Duke and Pearson 2002; Pearson and Gallagher 1983) to tablet use. Within this model, the teacher first explains and models the activity, followed by guided and independent practice by the student. However, such proposed models need to be tested and researched more extensively in diverse contexts in order to determine better their effectiveness.

17.2 TPACK

The teachers involved in the project had previous varied experiences with technology. Some of them used technology to a limited extent in their personal lives. However, all the teachers felt they required more professional development about how to integrate the tablets into their teaching and learning. There needs to be a clear instructional planning framework for teachers to integrate tablets into their teaching. Mishra and Koehler (2006) suggested that the most effective way to integrate technology into classroom instruction is for teachers to simultaneously draw on their technological, pedagogical, and content knowledge (TPACK). This involves an understanding of how technology and content are reciprocally related. Teachers often have a difficult time using their TPACK in a systematic and useful way (Hutchison et al. 2012). Hutchison and Woodward (2014) believe that there is a need for an instructional planning cycle that would guide teachers in using their TPACK.

Such a cycle which is referred to as a 'grounded approach' to technology integration is offered by Harris and Hofer (2009). This cycle involves choosing learning goals, making pedagogical decisions, selecting activity types to combine, selecting assessment strategies, and selecting tools/resources. The approach is not linear but recursive in that decisions and choices made at each of the five stages of planning will change as new developments will require adjustments. Another cycle specific to effective teaching with apps is that proposed by Northrop and Killeen 2013. It involves teaching the concept without the iPad, explaining and modelling the app, guided practice with the app, and independent practice with the app. Use of technology with effective instruction should ensure that students are actually learning.

One cannot underestimate the importance of providing teachers with school-based pedagogical and technological support. It was evidently clear that those teachers, who received adequate curricular and technological support in a proactive and timely manner, were in a better position to integrate the tablets into their lesson planning and delivery and to meet the challenges which they faced. There should be more opportunities for professional development and for teachers to engage in joint planning and peer teaching.

17.2.1 Context of the Study

The National Literacy Strategy for Malta of the Ministry for Education in Malta (2014) outlined the range of skills children need for reading and writing in Maltese and English, the two languages of schooling in Malta. In order to foster children's bilingualism and biliteracy, children need to be provided with specific learning opportunities, including access to learning materials in both languages and engagement in meaningful tasks. This chapter reports on a programme for the implementation of tablets in Maltese schools, which was framed within the National Literacy Strategy and the bilingualism requirement. The availability of open resources and a sustained focus on the nature and quality of relationships mediating children's experiences around different media and texts are crucial (Green and Hannon 2007; Neuman and Celano 2006; Yelland and Masters 2007). Au and Raphael (2000, p. 170) argue that 'ensuring educational equity involves helping students become literate in all artifacts of literacy'. The reference is not only to those skills historically used and present in today's society, but also to those likely to become prominent in the future.

In order to understand the impact of tablets and literacy apps on children's learning in Maltese classrooms, we need to be aware of the inevitable influence of teachers' practices and attitudes towards technology use. Previous research on tablets in classrooms shows that tablets can support teachers to be more flexible and to generate learning materials for students of different abilities and levels, especially with regard to struggling readers (Shuler et al. 2013). They can also allow increased communication and feedback opportunities between teachers and students (Snell and Snell-Siddle 2013) and support more autonomous (Wong 2012) and more personalised (Kearney et al. 2012) learning.

Several studies show that for technology to have a lasting positive impact, it needs to be integrated into existing classroom practice rather than provided as an 'add-on'. Meaningful integration of technology has the potential of transforming literacy instruction (Hutchison and Reinking 2011). In our study, we were keen to understand how literacy teachers in Malta integrated tablets into their existing practice. We focused on literacy because of our own expertise in this area and the official policy emphasis on technology-mediated literacy instruction. We were also mindful of the emergent evidence concerning the potential of mobile technologies for supporting the teaching and learning of literacy (Plowman and Stephen 2007; Beschomer and Hutchison 2013). For example, Flewitt, Messer and Kucirkova (2015) investigated the ways in which iPads might offer new opportunities as well as challenges for teachers in a nursery (3–4 year olds), a primary school reception class (4–5 year olds) and a special school (7–13 year olds) in the UK. They found a lot of variability in the ways iPads were used across the three settings, but concluded that well-planned iPad-based literacy activities can stimulate children's motivation in literacy activities and influence practitioners' perceptions about children's literacy competence.

17.2.2 Methodology of the Study

The theoretical framework

The primary theoretical influence in our conceptualisation of the training programme was Danielson's Framework for Professional Practice. It identifies aspects of a teacher's work that empirical studies have shown to promote improved student learning (Danielson 2007). The Framework divides the complex activity of teaching into twenty-two components clustered into four domains: (1) planning and preparation, (2) the classroom environment, (3) instruction, and (4) professional responsibilities. We were interested in exploring how the domains of teaching professional practice are influenced by the introduction of tablets in classrooms.

17.2.3 Study Context

The project team approached four local schools in Malta and invited them to participate in the study. Teachers and their classes of seven year-olds in these schools were given tablets, with a range of devices used across the schools, including Samsung Galaxy Tab 3 and 4, Intel Classmate TL101E1 Microsoft and LearnPad. In all the schools, tablets were provided for free by the government, with the view of expanding the programme with the most effective and popular devices later on. The schools were free to decide whether children may take the tablets home and all the schools, apart from one of the state schools, allowed children to take the technology home after the school day. Teachers were free to choose apps and programmes they wished and were encouraged to share their experiences of using the tablets in regular meetings with other teachers participating in the pilot. Professional development training was provided by the project team and involved a number of models for teaching through technology and the review of a number of age-appropriate apps. Training in hardware and software solutions was provided by a number of industry partners.

17.2.4 Continuity Between School and Home and Parental Involvement

The tablets also proved important for teachers to be able to communicate with parents and to ensure continuity and reinforcement at home of the work done at school. One teacher remarked that many of the literacy activities, such as reading comprehension, could be reinforced at home as the students were able to listen to the story with their parents.

In the initial stages of the project, the parents were asked to participate in an information meeting about the educational purposes of the tablet. They were given guidelines about how to help their children familiarise themselves with the tablet. The teachers acknowledged the specific importance of including and supporting parents in the process of the integration of tablets in teaching and learning. The parents warmed up to the idea of their children using the tablets as a learning resource after receiving encouragement from the teachers. The parents checked often their children's homework on the tablet, and also made use of a number of resources that were uploaded on the students' tablets by the teachers. Parents were eager to find out from the teachers about how the tablets affected their children's learning.

17.2.5 Training Programme Participants

The teachers involved in the training programme were from two State schools, one Church school and one Independent school. They were two classes from one of the state schools and one each from the other schools. These teachers were selected as they were making use of the tablets specifically for the teaching and learning of literacy.

17.2.6 Study Procedure

The aim of the study was to document and understand the attitudes and practices of the teachers and students involved in the professional development programme. An ethnographic approach, where a researcher observed classroom dynamics in their natural settings was adopted (Gallagher et al. 2015). Permission to conduct the study was granted by the Research and Development department of the Education Ministry in Malta. Ethical consent was obtained from the University of Malta Research Ethics Committee.

We observed 13 lessons in all, three of which were in Maltese and ten in English. A range of language activities in both languages were observed. These included listening comprehension activities and reading from digital books. In all the lessons, the teachers used also print materials such as handouts, copybooks, exercise and practice books besides the tablets.

17.2.7 Data Collection

At the beginning of the study, a focus group meeting was conducted involving all the participating teachers and a member of their school management team. Initial interviews were conducted with all the teachers. All classroom observations were followed by one-to-one interviews with the classroom teachers. The aim of these interviews was to understand more fully how teachers used the tablets to reach their lesson objectives. A final interview with each participating teacher took place at the end of the study to ascertain whether their perceptions and practices concerning the use of the tablets for the teaching and learning of literacy had evolved and might be sustained beyond the duration of the training programme. We also asked the teachers to keep a diary of how they used the tablets and to capture their reflections on the lessons. These were analysed together with the interview data at the end of the study.

All interviews were audio-recorded and transcribed verbatim by a researcher who is fluent in both Maltese and English. Transcriptions were shared with the teachers to ensure clarity and accuracy and to allow them to add more if they wished.

17.2.8 Data Analysis

The theoretical framework by Danielson (2007) was followed for all data analysis. Coding was related to the four domains and the relevant competences presented in this framework. All the raw data from the various sources: focus group, classroom observations, teacher interviews, teacher reflective diaries, student questionnaires, was analysed thematically by the two researchers. Comments were grouped and labelled through analytic-inductive methods with a term which captured the essence of the comments, with preference given to terms used by the participants in the interviews. Final themes were agreed on by the research team who conducted the analysis separately and agreed final themes by consensus.

17.2.9 Results

This study sought to identify the impact of the use of tablets when teaching literacy in primary classrooms in the four domains of Danielson's (2007) Framework for Teaching. The results show that the integration of tablets as a teaching tool had an impact on teachers' planning and preparation, their classroom environment, instruction and professional responsibilities. Teacher and student motivation were increased. There were improved learning outcomes and increased opportunities for differentiated and personalised teaching and learning. Student collaboration and school–home continuity were enhanced. The tablets allowed for alternative means of dissemination and evaluation of student work.

17.2.10 Planning and Preparation

This domain outlines how the teacher organises the content of what students are expected to learn. The teachers involved claimed that they first planned the educational objectives and then went on to discover which tablet resources could best help them to meet those objectives. The tablets allowed them to plan for multimodal and differentiated work in the classroom. They could even share their plans with the children of their class on the tablets.

17.2.11 Planning for Multimodal Work

The affordances of the tablets allowed the teachers to plan and prepare for multimodal work and to use 'multiple communicative processes' (Beschorner and Hutchison 2013). The functions of the tablet offered a wide range of means to learning through auditory, visual and creative means. Many of the apps connected the four language skills: listening, speaking, reading, and writing naturally within one app. Children were able to use the digital features of e-books independently. Some digital book apps, like Storykit, enhanced the connections between the language skills but allowed also the children to change the images and the text. This provided also many opportunities for the students to work together. One teacher said that through the use of tablets, 'Learning had become more interesting and stimulating for the students, that's basically what it's all about'.

17.2.12 Differentiated Teaching

Through the use of the tablets, materials and tasks presented to the students could be prepared at various levels of difficulty as well as to cater for different abilities. Three teachers felt that the introduction of tablets as a learning tool made a difference to their students with special educational needs. The students showed a more positive approach to learning. They were more eager to read and to participate in various classroom activities. Teachers were able to assign different levelled e-books to each child on their tablet. They observed that some of the children could read a wider range of more challenging texts from the tablet when compared to reading from print books.

17.2.13 The Classroom Environment

This domain involves the opportunities and interactions that occur in a classroom. The tablets allowed for increased collaborative work among the students, teacher and student motivation and provided real time access to resources and information.

17.2.14 Collaborative Learning

There was a shared belief by the teachers that the tablet is a useful tool to increase collaboration and teamwork among students. One teacher observed that the tablets increased also collaboration among the school, the students and the parents. There was also sharing of children's work which allowed them to provide peer feedback.

17.2.15 Increased Levels of Student and Teacher Motivation

The teachers observed that the students exhibited increased levels of motivation towards literacy learning since the introduction of the tablets. All of the teachers described their students as being ‘enthusiastic’ and that for them learning had become ‘fun’. Students seemed to have become more interested and engaged. Every teacher felt that using tablets for the teaching and learning of literacy had a lot of potential. When using the tablets, many more students, who either had difficulties or who did not show interest in learning, were engaged in the learning process. Four of the teachers determined that the levels of confidence of their students had increased when using tablets, both in their literacy learning and in their use of technology. The tablets offered the students the opportunity to be proud of their work and boosted their self-esteem. Since the introduction of tablets students were more eager to read. Increasingly students expressed more positive comments about reading. Teachers too had become more motivated. One of the teachers felt that the introduction of the tablets had improved her teaching and made her a ‘better teacher’. She felt that she could prepare better her lessons because of the large amount of resources available through the tablet. Everything was at her fingertips.

17.2.16 Real-Time Access to Open Resources and Information

The teachers agreed that one opportunity offered by the use of tablets was the ability to have instant access to a variety of open resources, such as on the internet, downloadable e-books, YouTube videos, online presentations, and so on. One teacher specified that the facility to conduct research on the tablets, create presentations and work in groups prepared the children for the ‘twenty-first-century classroom’. Students could search for additional information on the internet whilst working on a literacy assignment. The prospect of having instant access to a number of resources was seen by the teachers as beneficial since ‘in the long run it saved time’.

The teachers in the study made extensive use of grade-specific e-books for their reading sessions on the school virtual learning environment. The access to a virtual library increased enormously the range of graded readers to the children, for guided and supplementary reading. The teachers presented activities and tasks related to the e-books for the children to work on. They kept introducing new titles to the virtual library to which the students had access, and in this way increased considerably the range of books available, especially in English.

17.2.17 Instruction

This section deals specifically with the teaching aspect of this study and will focus on the engagement of students in a specific learning context.

17.2.18 Reading and Writing Activities

One teacher used Answer Garden for brainstorming sessions and to increase the students' vocabulary. By downloading the Multilink keyboard, the students in one class could write on the tablet using the Maltese font. In another class, the students got to a stage where they were downloading relevant apps on their own and sharing them with the teacher and their classmates during the regular class Show and Tell activities.

Apps were also used to plan writing tasks. Whereas previously students were asked to read out aloud what they had written, now they were asked to post this on the forum. The teachers felt that in this way the children could read each other's writing, even at home. When engaged in creative writing, the editing process became much easier for the children.

One teacher set her class what was described as a 'visualisation' task. The children were asked to read a story from the tablet. Then they were invited to 'imagine' the story and to draw their ideas from the story by means of an app in groups. Each group sent a picture to the teacher via e-mail. Follow-up activities involved predicting the rest of the story, writing the story in their own words and publishing this in the students' room of their school virtual learning environment.

Another creative writing activity involved students being asked to find information about different kinds of dinosaurs on the internet and to use the Paint app to draw a picture of a dinosaur. They were then instructed to record describing words on dinosaurs in a word bank which was then shared by the teacher. Finally, they were asked to compose and publish a story based on the character they had drawn.

In another activity, the students were asked to shoot a short video of their pet at home. Then they were asked to share this video with the teacher and classmates and to write about their pet.

17.2.19 The Language Aspect

The tablets increased considerably the versatility and richness of the pedagogical repertoire of the teachers and provided students with access to multiple learning resources in both languages. Despite the limited resources available for Maltese, the teachers were still able to design and produce their own materials in Maltese.

Therefore, the repertoire of the teachers was increased considerably even in the case of the Maltese language for which there is limited availability of online resources. One example of this was when one of the teachers conducted a lesson in Maltese about past tense verbs. The students were asked to submit verbs on their tablets using the application Answer Garden. The submitted verbs were later shown collectively on the interactive white board. The same teacher also prepared a quiz in Maltese using the e-learning platform.

One of the teachers pointed out that e-books were helping her students to improve their English reading skills and to acquire an ‘appropriate English diction’. Another teacher felt that her students’ language skills in Maltese, had improved since she had started recording readings from books for the students to listen to on the tablet. This provided the students with a wider repertoire of material in Maltese. They became more confident as they could listen to the text over and over again before attempting the reading of the relevant text themselves.

17.2.20 Dissemination of Work and Evaluation

Tablets allowed students to receive instant feedback from teachers as they could view their students’ work on the Interactive White Board. Students were able to share their work with others on the Interactive White Board, and therefore assumed an active role in providing feedback to their peers. Students also were able to submit their homework via email, ensuring feedback was more timely.

Through the app KidBiz 2000, one teacher could keep track of the levels of literacy of her children. She used this to check their reading levels at several intervals to see what progress they had registered through reading comprehension tasks. Through the app, the teacher could monitor the specific reading level of each child.

17.2.21 Improvement in Literacy Performance and Skills

All the teachers felt that the tablets made a significant difference to literacy outcomes, especially in the areas of reading, creative writing, sentence building and attention. They maintained that although it was normal for student literacy performance to improve over the months, students seemed more dedicated and eager to learn since the introduction of the tablets. According to one teacher, this was mainly due to the apps offered within the tablet. The ability to download e-books or record oneself offered students alternative means of learning.

17.2.22 Professional Development Framework

One of the purposes of technology use is to facilitate and inspire student learning and creativity (ISTE 2000). It can also increase student engagement and motivation (Chiong et al. 2012). The point of departure needs to be good teaching practices which are strengthened by the use of technology. Using Danielson's Framework for Professional Practice in teaching has enabled us to blend technology use with what is considered to be effective practice. In this way, it can be ensured that technology use is integrated effectively in sound pedagogical practices.

We feel that the professional preparation provided by this project provided a very positive experience for the teachers and students involved (Mifsud and Grech 2016). The teachers designed learning scenarios, activities, and assignments which were appropriate to the abilities of their students, making use of the digital resources on the school e-learning platform and on the internet. They planned for differentiated learning, including children with special educational needs. Classroom assessment of reading and writing was increasingly carried out through the technology.

There was a positive attitude on the part of both teachers and students towards technology use in the classroom. The technology provided opportunities for the students to 'publish' their work online to be viewed by other students and parents. There were increased opportunities for collaborative work among students in the classroom. Teachers and students co-created images, audio, and text which engaged them in a range of learning tasks. In this way, teachers were more likely to tap into children's interests, skills, and creativity (Nilsson 2010). The students sought information and researched relevant topics online in order to be able to produce their own work to fulfil instructional tasks which involved reading, writing, designing, and creating.

The teachers were able to monitor more efficiently their students' progress and to be able to relay this information to the parents. Classroom information was more readily shared with students and parents. The teachers communicated and collaborated online with colleagues to exchange and share teaching ideas.

17.2.23 School–Home Links

The students found it relatively easy to access from home the material on the tablet which was introduced by the teacher in the classroom. They could more easily review this work and continue it at home. This allowed for increased involvement by parents as they were able to monitor better the work that their children brought from school. Technology provides a good opportunity to connect school and home learning activities (Northrop and Killeen 2013). However, there needs to be a structured framework for strengthening school–home links and for increased parental involvement through the use of the technology. Parents need to be brought on board as informed partners. Meetings are to be held with parents to inform them better about the integration of the technology into their child's learning path, and about the e-learning platform which allows them access to relevant educational materials. In this way, they can become more active participants in the learning path of their child.

17.2.24 Professional Responsibilities

This domain represents the wide range of a teacher's responsibilities outside the classroom.

17.2.25 Professional Development

The teachers felt that the introduction of tablets had brought about a change in their teaching strategies and classroom management techniques. It was a learning process for them. They had received professional support to use the tablets and to create relevant lessons from fellow IT support teachers, who eased off gradually for the teachers to assume increased sole responsibility for using the tablets in the classroom.

There were also opportunities for online collaborative planning among the teachers using the tablets in their classrooms which allowed them to share ideas or resources. This increased their confidence and provided them with a larger repertoire of strategies and resources.

17.2.26 Discussion of Results

A case for more cohesion and integration

To conclude, this chapter has highlighted the complexities present for parents, caregivers, and educators, in integrating digital and print literacy into children's early reading experiences. There are commonalities and continuities between the forms, for example, to read via both modalities, children need to acquire the basic skills of letter-sound decoding, and learn to link the resultant word forms to meaning. There are also key differences, like the increased multimodality of digital books, which makes reading a far less linear experience. For adults who have learned to read via print books and for educators who have learned to teach reading via print books, this shift creates a scenario where adults, as reading 'experts', do not necessarily have all the answers yet, in terms of how to best foster the resulting 'multi-literacies' that children must learn. As described above, this reality can create challenges as well as exciting opportunities.

Parents and educators need to recognise how print and e-books can complement each other. Young children appear to be developing sophisticated strategies in order to make sense of digital texts. If teachers are expected to build upon these strategies, more research in the dynamics of technology-enhanced classrooms is needed to fully understand these strategies, and build upon them to ensure that all students are included. We need to deepen our 'understanding of how young children read digital texts at home and at school. Such knowledge is crucial in order to inform curricula and pedagogy on the teaching of reading to twenty-first-century children' (Levy 2009). Further research is required also to investigate the effects of tablet writing on literacy development. Such research should illuminate policy and practice in this field and provide the sufficient basis for parental and early childhood teacher education.

Teacher preparation and continuous professional development must inform teachers of the literacy skills necessary to succeed in today's work environment (Mikulecky and Kirkley 1998). Teachers need to be prepared to use these skills and to integrate technology seamlessly within their literacy curriculum (Karchmer 2001). They need to be presented with positive models of technology integration in the literacy curriculum (Calderhead and Robson 1991).

17.3 Conclusion and Future Considerations

We believe that if planned well and the necessary preparations are made at the various levels, the introduction of tablets has the potential of bringing about a dramatic and positive change in classrooms. Technology integration decisions may be better incorporated into the ways teachers typically plan for teaching and learning. This development may have a strong impact on the teaching and learning of literacy in our classrooms and have the potential of stimulating children's motivation and concentration (Flewitt et al. 2015). There should be adequate provision of the required professional education and development of the teachers involved. Technological and pedagogical support structures in schools are to be improved and extended. A framework for the strengthening of school–home links and increased parental involvement is to be designed and implemented. Technology and effective teaching will continue to evolve. Good teaching practices should integrate technology to enrich learning.

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Chapter 18
Learning Alone or Learning Together? How Can Teachers Use Online Technologies to Innovate Pedagogy?

Christina Preston, Sarah Younie, and Alison Hramiak

18.1 The Context

A key issue in introducing digital technologies into learning has always been the lack of adequate CPD (continuing professional development) for teachers. Although the Covid-19 global pandemic in 2020 has created high levels of interest in online learning, it has not been possible to quantify the amount of training for teachers in all phases has increased.

A key means of training teachers to work online in a way that limits training costs is to encourage teachers at schools, HE and VET levels to join a community of practice because teachers gain experience from each other in practical performance (Thompson et al. 2013). This observation was made earlier by Preston, when the 1980s' computer networks were established in most UK schools and she became an IT adviser. She quickly found that the one-day computing courses offered at the Inner London Education Computing Centre (ILECC) were ineffective for many London teachers for three reasons: they had not studied computing in their first degree; they did not own their own computer; and, they were only offered one computing session a year.

So in 1992, she founded the first online 'community of practice' (CoP), the MirandaNet Fellowship where teachers, teacher educators, researchers, policy-makers and developers could support each other in figuring out the most effective ways to use computers to enhance learning in all phases of education (Preston 1995, 1999a, b). One could argue that the earliest example of a CoP is a medieval trade guild, although Wenger (1998, 2002), who is credited with developing the phrase,

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used the term to describe the processes by which professionals work together to further their skills and knowledge collaboratively in education and in business.

The authors of this chapter are all long-standing members of the MirandaNet Fellowship, where the international members who join for free are all experts in education technology. The development of the theory and practice of online learning by this professional CoP forms the research base that we draw on to outline the history of an online CoP.

18.2 The Research Questions

MirandaNet online research and development in teaching and learning has been funded over three decades through research collaborations with multinational companies; schools and academy chains; foreign governments impressed by the UK's achievements in this area in the 1990s and 2000s; the European Union; and, by UK government agencies like the TTRB (Teacher Training Agency) and Becta (British Education Communications Technology Agency) that were closed in 2010.

During those years from 1994 to 2010, the funding was made available to experiment with learning in order to implement their integration into schools. MirandaNet Fellows were engaged in a variety of funded projects and were propelled by a professional interest in how digital technologies might expand learning in all phases.

The authors have analysed the projects that were undertaken to identify the key underlying research questions:

Which technologies facilitate effective knowledge sharing?
Which pedagogical theories underpin collaborative online learning?
What roles should a CoP adopt in knowledge sharing and theory creation?
How do MOOCS change the online learning landscape?
What is the role of MOOCs in schools?

18.3 Methodology

The MirandaNet Fellows have always been advocates of ethnography, a specific kind of qualitative observational research which provides an account of a particular culture, society, or community. An example is where fieldwork involves spending a year or more in the case-study setting, living with the local people and learning about their ways of life (Denzin and Lincoln 2000).

In this case, Fellows have evolved this methodology to observe their own practice online. As part of this process, MirandaNet Research Fellows advocated practice-based research as a professional learning method that we call iCatalyst. This contrasts with the research approach in which the teachers are objectively observed by researchers who withdraw to write a report that the teachers often do not necessarily see: in this way, no change in practice is achieved. In the iCatalyst programme, the teacher participants become co-researchers working alongside the researchers, commenting on their own practice and agreeing change within their sphere of influence.

Working with all key stakeholders, the teacher participants identify what they want to gain from their investment in digital technologies. Crucial to success is the methodology of collecting of evidence of learning online and the ability to measure the impact of implementation. As co-researchers, the participants build a professional community in order to amass the evidence, they need to underpin the changes they want to make. This can be just a small group of e-mentors within a school or a region. Publishing case studies on the MirandaNet website, enables Research Fellows to continue to build the MirandaNet Knowledge Hub where professionals can share and disseminate knowledge to a global audience of like-minded professionals.

Qualitative approaches to education research are now well established. Nevertheless, some quantitative specialists remain suspicious of practice-based research, citing the limitation that practitioners cannot be sufficiently objective about their own ways of working. But this limitation is outweighed by the iCatalyst programme advantage that good practice is being fed back into teaching and learning methods in real time so that the teachers can adapt what they are doing in their learning environment. This approach is particularly helpful when virtual platforms are utilised because the participants are not meeting face to face to share their ideas. Several different online learning projects were undertaken and conducted by Fellows, and gradually, a Fellowship view began to emerge about theory and practice in relation to e-learning.

18.4 Findings and Discussion

The MirandaNet CoP has been experimenting with online learning since 1994 when the CoP had its first email listserv: the first virtual debating forum, for members, that only used text. Later, Fellows explored video conferencing and the potential of Second Life, in which each participant designs their own avatar to represent them in the virtual space. The use of appropriate technologies has been expanded as the membership has grown, with now to more than 1500 worldwide.

Terms to describe the processes of teaching and learning online in these different mediums increased and eventually new terms emerged for the techniques that MirandaNet Fellows were developing. In 2013, in the context of collaborating on a European project that developed a Massive Open Online Course (MOOC). MirandaNet Fellows refined their own approach, built up over the previous two decades, as a Community Online Open Course (COOC).

During this period, we have developed theory and practice from a range of projects that we have distilled into five thematic strands: technologies for knowledge sharing; pedagogical theories underpinning collaborative online learning; roles for

CoP members in online debate; the impact of MOOCs on learning; and, the role of MOOCs in schools. The first question we address is:

18.5 Which Technologies Facilitate Effective Knowledge Sharing?

In universities in the 1990s and 2000s across the world, online platforms were mainly regarded as repositories; as a means of storing resources online so that students could access them and learn from them as they would notes from a lecture. The pedagogical approaches of online collaboration and mentoring was not central to the design. There was no question that the first Virtual Learning Environments (VLE) like Blackboard, an American product, reinforced traditional information transmission pedagogy. The obvious development from this has been Specialist Online Open Courses (SPOCs) where teachers lecture and point their students to resources that will help them learn. Indeed, some SPOCs just provide routes through resources for learners. SPOCs can be very important in situations where the learners' location is remote, they have to learn from home or funds do not exist for face-to-face teaching.

Over these early years, the MirandaNet Fellows used their web spaces to research the innovative use of digital technologies in collaborative learning, knowledge creation and analysis of current professional knowledge, an approach that combines online learning and social connections. These ideas relates to emerging practice in collaborative games players engaging remotely in virtual worlds; remotely authored concept maps; social networking; and. Micro-blogging. These democratic, collaborative knowledge creation opportunities are causing ripples in social and cultural contexts, although they are not widely exploited for learning yet. Nevertheless MirandaNet, like many CoPs, would find it difficult to operate without wikis, micro-blogging, social networking, video-conferencing tools and remotely authored digital concept maps listservs, TwitterWalls, Second Life and the latest virtual conferencing software.

18.5.1 Community of Practice – Constituent Parts

The term 'community of practice' is derived from the work of Lave and Wenger in 1991 and furthered developed by Wenger in 1998. Wenger's model provides an analysis of the constituent parts of a 'community of practice', which he describes as 'a special type of community'. Wenger outlines three dimensions of practice which are the property of a community: 'mutual engagement, joint enterprise and shared repertoire' (1998, p. 72–85).

Mutual Engagement: This involves all members of the group working together and engaging in shared work practices. Members build up relationships through working together and 'connect meaningfully…to the contributions and knowledge of others' (Wenger 1998, p. 75–6).

Joint enterprise: This involves members negotiating their joint endeavour. The participants create their shared purpose in the process of pursuing it. 'It is their negotiated response to their situation and thus belongs to them in a profound sense, in spite of all the forces and influences that are beyond their control'; the enterprise is joint 'in that it is communally negotiated' (Wenger 1998, pp. 77–82). Joint enterprise is 'a process, not just a static agreement'. It is shaped by the participants 'as they pursue it', in the course of 'creating relations of mutual accountability' (ibid.).

Shared repertoire: This includes the routines, words, stories and actions that have been developed by the group in the course of working together. This shared repertoire is, however, dynamic: it 'reflects a history of mutual engagement'–community members bring with them their own repertoires and are continually shaping new repertoires as they work with one another (Wenger 1998, pp. 82–84). Wenger also acknowledges the importance of differences and conflicts as creative components of a 'community of practice' too.

The usefulness of this model, as with all models, lies in providing a framework that enables us to analyse the complexity of online community knowledge creation and identify the cultural dynamics of those interactions.

18.5.2 Developing an 'Unconference' – MirandaMod

As the years progressed, MirandaNet Fellows knitted together several different technologies so that MirandaNet members in a physical room in a face-to-face conference setting could debate directly with members who could not attend the conference in person. Those who were unable make the journey for whatever reasons were then not disadvantaged and were still able to participate. The generic term for this mix of 'real and virtual' event is an 'unconference', in which the input of all the participants has equal weight. This contrasts with a conventional conference with named speakers who take questions at the end of their talk. A 'Mod' is a Scottish word for a meeting and one of the members, Drew Buddy, coined the term MirandaMod for our debates using collaborative digital technologies that could be used to capture notes from which to publish papers and case studies to inform educators globally (See Fig. 18.1).

Another technique utilising online collaboration for knowledge building, which was developed during the MirandaMods, was the use of online concept mapping, as enabling the capturing of ideas through group debates. See Fig. 18.2.

This method of developing a communal digital concept map has been adopted to create a growing body of knowledge, in which each participant in the debate can help to build the knowledge. The URL has been provided in the references as well as this image of the map, as already A4 paper reproduction of knowledge building is inadequate for this kind of collaborative work.

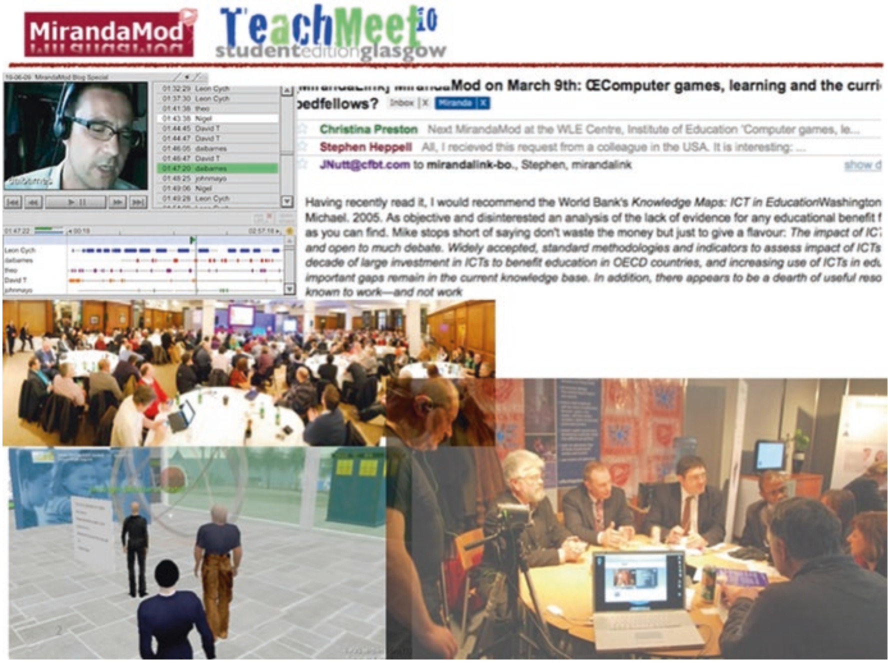

Fig. 18.1 MirandaMods held in a variety of professional development contexts

18.6 Which Pedagogical Theories Underpin Collaborative Online Learning?

MirandaNet Fellows are now relating their practice of creative knowledge building in MirandaMods to the term, Community Online Open Course (COOC). In this context, a MirandaMod generates a shared liminal space (see Fig. 18.3) that is important to building professional knowledge. This can be inchoate and chaotic as learners' conceptions and misconceptions, understanding and misunderstandings clash and co-mingle. 'Liminal space' is a term used generally to describe the dissolution of order in an individual's mind during liminality that creates a fluid, malleable situation that enables new connections and new expressions of commonality to become established, thus changing existing practice.

MirandaNet Fellows, Cuthell and Preston (2005) and Cuthell et al. (2009) argue that social liminal space can be conceptualised as anthropological and contains semiotic elements that can be visual as well as written. In the public sphere created at the interface of face-to-face and virtual communicative action, all learners, professional or otherwise, could act in the Brunerian sense (1974) as scaffolds to support each other as they traverse liminal space together to reach shared and individual enlightenment and transformation. See Fig. 18.3.

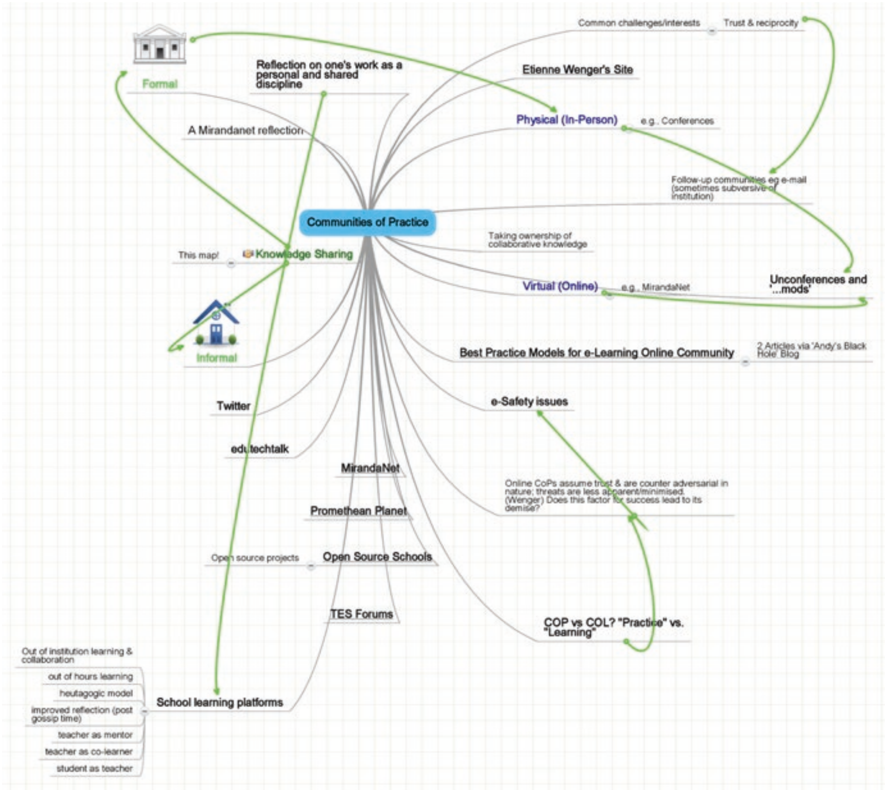

Fig. 18.2. A remotely authored concept map on Mobile learning developed by MirandaNet members

This approach builds on the work of MirandaNet Fellows Leask and Younie (2001) and their conception of 'communal constructivism', which is an innovative extension of Vygotsky's (1978) 'social constructivism'. Communal constructivism can be understood as different from Vygotsky's conceptualisation, in that Leask and Younie conceive of the 'other' as not necessarily more expert, but rather as equal collaborators building knowledge together.

With social constructivist approaches to learning, this prioritises peer-to-peer knowledge construction, which in Vygotsky's ZPD (zone of proximal development) scaffolds learning with a more knowledgeable other guiding the learner to extend their understanding. With communal constructivism, we argue that teachers in CoPs can learn from one another and in an online community, this can be done with technology, which facilitates both online communication (sharing ideas) and recording through online collaborative wikis, concept maps and collective publishing.

Learning is conceptualised as collaboratively co-creating knowledge, through cooperative, peer-to-peer, informal learning and interaction, using digital technology. The affordances of digital technologies for online communities enhance creating, sharing and building new knowledge together; with and for each other; this is

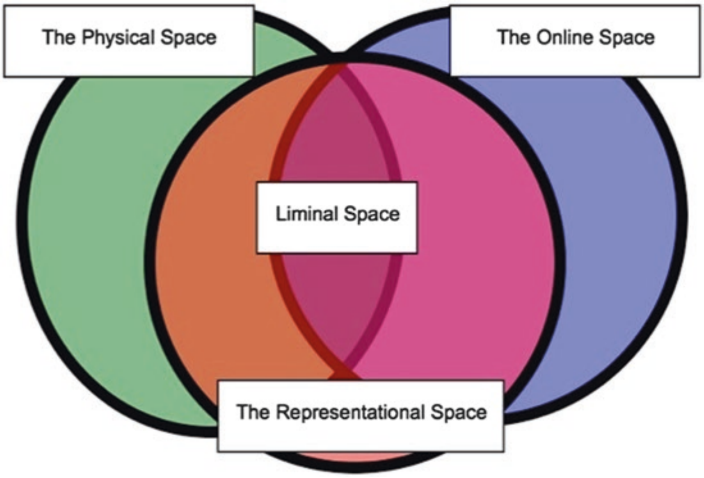

Fig. 18.3 Liminal space theory adapted to include shared online spaces

communal constructivism. So, 'knowledge is created by teachers for teachers: for use by each other: mutuality' (Younie 2007, p. 311) (Table 18.1).

MirandaNet Fellows have adopted a metaphor to describe the theory underlying this collaborative knowledge creation called Braided Learning (Preston 2007a), which refers to the notion of plaiting ideas together. Sharples (2012–2018), a MirandaNet Senior Fellow, has also been working in the area of innovation in collaborative learning in and he offers two terms that help to describe the learning conditions demonstrated in a MirandaMod: 'seamless learning' and 'rhizomatic learning'. The first, seamless learning, defines the experience of continuity of learning across a combination of locations, times, technologies or social settings. This can be seen as learning journeys that can be accessed on multiple devices, flow across boundaries between formal and informal settings, and continue over life transitions such as school to university and workplace.

The second term, rhizomatic learning, is derived from the metaphor of a plant stem that sends out roots and shoots that allow the plant to propagate itself through organic growth into the surrounding habitat as in Fig. 18.4. Seen as a model for the construction of knowledge, rhizomatic processes suggest the interconnectedness of ideas as well as boundless exploration across many fronts from different starting points. An educator reproduces this effect by creating a context within which the curriculum and knowledge are constructed by members of a learning community and which can be reshaped in a dynamic manner in response to environmental conditions. For further exposition, see Sharples (2019) Open University Innovative Pedagogy annual reports, which are collated into a comprehensive book.

Figure 18.4 illustrates a rhizome; providing a visual image for the way in which knowledge is constructed by self-aware expert communities adapting to environmental conditions.

Table 18.1 Theories and approaches to learning

Relevant learning theories	Key ideas	Learning is conceptualised as:
1.1 Constructivism Piaget (1963)	Constructive–individual focus Concerned with how knowledge and skills are internalised Cognitivist Developmental	Learning is conceptualised as individuals actively exploring the world and receiving feedback Constructivity–is the integration of new concepts and skills into the learner's existing conceptual /competency structures Pedagogical applications: knowledge building requires interactive environments Need activities to encourage experimentation and discovery of principles Need support for reflection and evaluation
1.2 Social Constructivism Vygotsky (1978)	Constructive–social focus Zone of proximal development Understand learner and scaffolders' roles in collaborative activities	Individual learning is scaffolded by the social environment Teachers/more knowledgeable peers have a key role in dialogue and interaction with the learner; how learners can progress beyond their immediate capability by supportive others scaffolding the learning experience Pedagogical applications: knowledge building requires interactive environments Need activities to encourage collaboration and shared expression of ideas/dialogic approach Need support for reflection, peer-review and evaluation
1.3 Communal Constructivism (Leask and Younie 2001) Holmes et al. (2001)	Social constructivism - dialogic learning with technology Situated learning and distributed cognition, using digital technologies for social/ professional online networking for knowledge management	Social theories of learning (peer-to-peer knowledge construction) and the affordances of digital technologies (to create, share and build new knowledge online together; with and for each other) Learning is conceptualised as collaboratively co-creating knowledge, through cooperative, peer-to-peer, informal learning and interaction, using digital technology
1.4 Situated Learning Lave and Wenger (1991)	Communities of Practice Situative CPD Work-based learning Situated learning	Learning is conceptualised as participating in communities of practice Developing from novice to expert, focus on situativity attends to the social context of learning Authenticity of the environment and support for peer-to-peer learning are highlighted

(continued)

Table 18.1 (continued)

Relevant learning theories	Key ideas	Learning is conceptualised as:
1.5 Experiential Dewey (1938) Lewin (1951) Kolb (1984) Beard and Wilson (2006)	Experience is the foundation of learning Learning is holistic, socially and culturally constructed Learning is shaped and influenced by the socio-economic context in which it occurs	Learning is conceptualised as–learning from experience Experiential learning is the process of making meaning from direct experience, upon which, reflection is encouraged to increase knowledge, skills, values and beliefs Emphasis on learning by doing Pedagogical applications: action learning; problem-based learning; emphasis on critical thinking and problem solving Experimentation/experiential learning are constructivist; focus on how learning opportunities allow progressive discovery of concepts and skills
1.6 Behaviourism Watson (1924) Pavlov (1927) Skinner (1953)	Classical and operant conditioning Antecedents, behaviour, consequences Stimulus-response Reward and reinforcement Trial and error learning	Learning is conceptualised as association between stimulus-response Focus is on measureable behavioural outcomes of learning, rather than knowledge, understanding, values, attitudes and beliefs Associative concern with external behaviours (not with how concepts/skills are represented internally) Pedagogical applications: instrumental teaching, drill and practice, rote knowledge

Adapted from Younie and Leask (2013)

Fig. 18.4 The Rhizome visual metaphor for developing community knowledge creation

This community approach to professional development for teachers has been endorsed by Bell et al. (2013) in reviewing how teachers in New Zealand keep up with the move towards computing science in their new curriculum for schools; a curriculum and professional development programme that has been widely praised (Clear and Bidois 2005).

18.7 What Roles Should a CoP Adopt in Knowledge Sharing and Theory Creation?

These social, conversational processes, as well as personal knowledge creation, can be linked into unbounded personal learning networks, that merge formal and informal media. Working with teachers, MirandaNet Fellows Leask, Preston and Younie have shown that teachers in communities can develop new theories and practice that are valuable for influencing policy at many levels (Leask and Younie 2001; Leask and Preston 2009; Younie and Leask 2013 – see Table 18.1).

What we found is that these knowledge-sharing events had to be well prepared and sufficiently scaffolded with clear roles assigned to mentors, in order to facilitate dialogic learning and collaborative knowledge creation; see Tables 18.2 and 18.3 below. Mentors reported that in the online debates, the pedagogic stages elicited productive 'liminal spaces' for teachers to share, challenge, deconstruct and reconstruct knowledge (Table 18.2).

In addition, a series of key roles began to emerge as the CoP became more e-mature, as shown in Table 18.3 (Preston 2007a, b).

Table 18.2 Collaborative knowledge creation stages

Life cycle of an online discussion
Presenting a lively and engaging title
Setting the context and timeline
Invite the appropriate potential audience
Agreeing objectives
Deciding the timelines
Introductions
Welcoming newcomers
Eliciting permission to use the material generated in follow-up reports
Acknowledgements of conflicting points of view
Posing stimulating questions
Interim summaries to include opposing arguments
Requests for information and references for different reporting exercises
Closure statements

Table 18.3 Debating roles in evidence in MirandaNet debates

Provokers	Conciliators
Practitioners	Theorists
Contemptuous debaters	Respectful arguers
Lurkers	Limited female input
Generous purveyors of knowledge	Humourists
Strategists	Poets
Pessimists	Optimists
Stream of consciousness writers	Minimalists

This is not, of course, an exhaustive list of potential roles, as these are likely to be as varied at the participants' characters. The roles will also be different in different kinds of CoPs, although some will occur in every successful debate. Seeing these roles online is one of the appeals of online working. . These roles, however, are not essentialist, as they are not mutually exclusive. This online environment is also a space where people who are shy, or who like to have time to answer, begin to display their in-depth knowledge in a way which may not be possible in a face-to-face conference. One of the challenges for the CoP is to find the right balance between formal and informal communication. However, quick responses online without eye-to-eye communication and body language can seem raw and confrontational. However, the key point is that the online CoP is a network of educators known to each other who share mutual interests.

18.8 How Do MOOCS Change the Learning Landscape?

This growing body of MirandaNet theory and practice, drawing on Braided Learning (Preston 2007a, b) and communal constructivism (Leask and Younie 2001), has been challenged by the advent of the Massive Open Online Course (MOOC) that can attract 45–50,000 participants who have no past history with each other. MOOCs seem to transform the ways in which adult learning is delivered, particularly informal and self-directed learning for those who cannot attend institutions like Stanford University for reasons of geographical location but for whom online access is possible. However, in these circumstances, the role of the e-mentor becomes problematic because of the number of mentors needed to cover the numbers of students and the cost of that model. In addition, the real time demanded of the lecturers online is never accurately rewarded (Laurillard 2014).

The question of e-mentoring became apparent in the first pilot of the EU-funded project Hands-On ICT, which aimed to develop a MOOC for teachers. MirandaNet was one of the partners charged with exploring the value of Massive Online Open Courses (MOOCs) and Community Online Open Courses (COOCs) in professional learning. In essence, the Hands-On ICT MOOC was a holistic environment that provided teachers from higher education, vocational education and schools with everything they needed to learn about making the right choice of digital tools for a given pedagogical activity. The Hands-On ICT team from England, Greece, Slovenia, Spain and the Netherlands based the design of the MOOC on the contexts and practices that were identified in a report about existing e-learning projects already underway in Europe (Riviou, Barrera and Domingo 2014).

The MOOC was underpinned by mutual peer e-mentoring. . However, the mentoring role implies responsibility for other students (teacher participants) and a generosity with time that cannot always be relied on. Questions were raised about whether there should be tangible rewards for mentoring effort; since no payment would be involved, qualifications in e-mentoring were mooted. But how would success in mentoring be judged: test scores; digital competence; the quality of responses in a forum or whether the teachers have implemented these ideas in the classroom? Tests can validate knowledge as evidence: however, there should also be a way to validate performative evidence. One way is for the participant to upload a digital artefact used to support, pedagogic practice, together with a commentary and evaluation. Publication was another route that was expected to motivate the teachers to develop digital artefacts to share more widely with others, and other online dissemination strategies like the Mapping Educational Specialist knowHow (MESH) initiative (see www.meshguides.org.uk).

The major finding from the EU project was that the designers of the Handson ICT MOOC needed to engage in some significant rethinking because the underlying supposition that all students (participating teachers) are the drivers of their education and will self-organise and professionally network is not necessarily the case. Some will only want an academic course focusing on information transmission.

These findings raise again the difference between those who just want to learn what is necessary for themselves as individuals and those who want to join a professional CoP and contribute to creating new collaborative knowledge. Each position is valid, but learning in a MOOC can be a lonely affair if ementors are not there to support (Preston and Younie 2014a, b, c).

18.9 What Is the Role of MOOCs in Schools?

Whereas the previous findings are about adult collaborative knowledge sharing, this section is about how children have fared in using collaborative virtual platforms. In this context, a short history of research and development in education technologies is important because the issues that emerged at the turn of the century are still in existence now. In the U.K, the internet was opening up in education from 1997 when the government funded the National Grid for Learning (Younie 2007). A key stimulus was the commitment of the New Labour government to digital education in 1997 which meant that in the first decade of the twenty-first century, UK educators were world leaders. One of the reasons was that the UK was seminal in designing a national curriculum that had three compulsory strands: Literacy, Numeracy, and Information and Communications Technology. This government policy attracted the attention of the multinational technology corporations, namely Apple, Microsoft and Oracle. Then Becta, the government agency for information and communications technology, decreed that all schools should adopt a virtual platform.

Indeed, because of the British early adoption of online learning, MirandaNet was chosen by Oracle to lead in their research and development in education from 1999 to 2002 rather than an American research consultancy. Larry Ellison who was the co-founder, executive chairman and chief technology officer of Oracle Corporation set up a charitable arm, The Oracle Education Foundation, that donated significant funds to philanthropic causes. The first project was online platform called 'Think.com' for school pupils that was, in fact, an early precursor of Facebook. Ellison invested $14 million dollars of his own money into this enterprise because he believed that it would change teaching and learning forever. The free platform was intended to provide every secondary school child with an email address and a publication opportunity to share their work. The content of the platform was developed by the teachers and the students.

MirandaNet Fellows worked closely with the pilot teachers in England and their pupils for 2 years. The idea was that teachers could better integrate learning projects into their everyday professional practice using Think.com. This free and protected online environment offered individual web pages for students and teachers, interaction and collaboration tools, and a powerful, shared project space for creating and managing learning projects. The project rationale explained that these easy-to-use tools encourage students at school and around the globe to share and communicate, increase their cross-cultural awareness and gain technology literacy, alongside other twenty-first-century competencies such as creativity and collaboration.

In the guide for teachers that MirandaNet produced, the platform was described as supporting collaborative learning communities. In the handbook, we suggested that the online community as a whole (a school, for example) may comprise numerous smaller communities with narrower and more specific common interests (such as a subject or a year group). Members may be students, teachers or education professionals (Dorner et al. 2000).

However, this learning opportunity was ahead of its time and significantly was influenced by the American commercial model. For instance, during the first school summer holiday, the developers in San Francisco launched a new version, but they had wiped the first-year content in version one developed by the teachers and the students without asking. This was not popular and worked against Oracle's aim which was to attract large international numbers of young learners to their platform and keep them loyal throughout their lives. This approach has, indeed, worked with Facebook, albeit for social networking, rather than for professional learning communities.

MirandaNet Fellows were working on Think.com programmes to help teachers to understand the principles of online learning and to enthuse them in mentoring their pupils about how to use this new learning environment. But Oracle in America had concerns about safeguarding as online grooming emerged about adults invading students' space online. After 2 years, Oracle excluded the children's teachers and just employed a few ementors who were not known to the students. Understandably, the teachers were not keen to integrate this platform into their professional practice when their own access was denied. Indeed, without the teachers motivating and mentoring, the students' usage dropped significantly. Then, after the attack on New York of 9/11, the American Oracle branch grew concerned about children contacting each other across the world. This innovative learning application was withdrawn along with an opportunity to understand those from other cultures.

18.10 Conclusions

So what has happened with education technologies in schools in the U.K since a change in government in 2010 and an abandonment of a specific education policy on technology? Turvey and Pachler, both Senior MirandaNet Fellows, explain how British teachers have been let down by a decade of political inaction on digital technologies:

> 'Our recent research shows that teachers have been hampered by weak policies surrounding technology supported learning…. To unlock the educational potential of digital technologies in the future, teachers need support which focuses on innovation and practice….
>
> Past standards required trainee teachers to develop their knowledge and skills in Information and Communications Technology in their teaching practice and wider professional work. However, all reference to the use of digital technologies for teaching and learning were removed from the 2010 Teacher Standards which trainees need to demonstrate to gain Qualified Teacher Status in England.
>
> These policies, as well as an era of real-term cuts in education funding, have left many schools' access to digital technologies weakened. It is not surprising that many, though not all, have found the move to remote and digitally-supported learning during the coronavirus pandemic challenging'.

We acknowledge that not all teachers as learners want to collaborate and share knowledge. Teachers might be time poor and just want to master current knowledge on the topic they are interested in. But, meanwhile, MirandaNet fellows continue to work closely with other education colleagues in related CoPs (e.g. Naace; Technology, Pedagogy and Education Association; and, MESHGuides). We also stand by our key finding that where possible elearners at whatever age should feel part of a learning community in order to achieve effective support and professional learning. In these circumstances, teachers have more impact if they take the role of mentors guiding the learners through the online resources and learning tasks that are supplied and also encourage the learners to collaborate and post their own discoveries. Our evidence indicates that joining a professional CoP or establishing a new CoP will assist teachers who have these aims.

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Collaborative Digital Concept Map One can also view the map here: http://www.mirandanet.ac.uk/mirandamods/archive/the-role-of-communities-of-practice-in-teaching-and-learning/
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INGOTS http://theingots.org/community/about
Learning Design support Environment https://sites.google.com/a/lkl.ac.uk/ldse/
Mapping Educational Specialist knowHow MESH http://www.meshguides.org/
MirandaNet Fellowship www.mirandanet.ac.uk
MirandaMods https://mirandanet.ac.uk/what-is-a-mirandamod/
Naace naace.co.uk
Technology Pedagogy and Education tpea.ac.uk

Chapter 19
The Affordances and Constraints of Digital Solutions for Learning Support and for Outreach

Gráinne Walshe

19.1 Introduction

In recent decades, digital teaching and learning has become a major part of the educational landscape internationally (Rodrigues et al. 2019). This slow and steady trend has been propelled to the forefront of academic policy and practice by the overnight move to emergency remote teaching and learning as a result of the shutdown of schools and campuses due to the COVID-19 pandemic (Nordmann et al. 2020). In Ireland, digital learning is one of four key strategic priorities of the National Forum for the Enhancement of Teaching and Learning in Higher Education (National Forum 2019), while the Irish Department of Education and Skills published its policy document on its Digital Learning Strategy for schools in 2015 (DES 2015), followed by the implementation of the Digital Learning Framework for schools in 2018 (DES 2020). New curricula designed for second-level are supposed to incorporate opportunities for teachers to implement digital technologies and for students to become digital consumers and creators (NCCA 2019). In higher education (third-level), universities are incorporating digital teaching and learning across all aspects of teaching and learning. There are clear advantages associated with digital teaching and learning (broadly known as e-learning), just too as there can be barriers to implementing it in practice, as well as constraints on its effectiveness as a tool for supporting student learning (Arkorful and Abaidoo 2015). It also encompasses a huge range of activities, from informal use of YouTube to high-level institutionally-supported use of virtual learning environments (VLEs). Clearly, these are not commensurate 'digital solutions' and therefore they neither confer the same benefits nor present the same challenges.

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The use of digital learning solutions, as with all learning solutions, must be customised and nuanced: second-level education and third-level education are very different pedagogical environments, and what works in one may not work in another. A fully online learning module may be the perfect solution for a person who is working or caring full-time, and who wishes to take pursue a Master's programme. School students are likely to need more face-to-face interaction with a skilled teacher in order to become engaged in their learning. However, even at third level, there are many considerations to be taken into account when designing and implementing digital teaching and learning initiatives, particularly for students at high risk of failing to progress (Boling et al. 2012). Lessons therefore can be learned as to how best to maximise the potential that digital learning surely offers, by looking at specific instances of their use.

19.2 Advantages and Disadvantages of Digital Teaching and Learning

It is important to note that use of digital technologies is not automatically transformative of learning (Henderson et al. 2017). Henderson et al. (2017) found that while undergraduates made good uses of digital technologies, those uses and practices were 'not the most expansive, expressive, empowering, enlightening or even exciting ways that digital technologies could be used'; in fact, they were often just expedient ways of revising for examinations, or researching for assignments (p. 1578). The broader issue here may be that third-level educators are not well informed about the implementation of digital teaching and learning. Certainly, a review of the literature on efforts to implement technology at second level found that there are serious barriers to be overcome, both at the level of the school (lack of effective training in solving technical problems, lack of technical support, lack of access to resources and lack of time to resolve these issues) and at the level of the teachers themselves (lack of confidence, lack of competence and resistance to change in integrating technology) (Bingimlas 2009). Educators at all levels have to be given the opportunity to develop the technological pedagogical content knowledge (TPACK) required to incorporate digital technologies of whatever kind within their teaching practice (Mishra and Koehler 2006), and while this can be very successfully achieved, it will take considerable time, effort, and external support (Johnston et al. 2019). The same will apply to the development of any kind of digitised content or resources. Even putting aside the issue around the pedagogical necessity or otherwise for developing any given set of digital resources, the processes involved in implementation of digital solutions are a whole new area for many educators (Moller et al. 2008). The next section outlines the general methodological requirements for designing and developing good digital solutions for teaching and learning.

19.3 Designing Digital Resources for Teaching, Learning and Outreach

There are well-established methodologies for the design, development and evaluation of high-quality and evidence-based instructional materials, including online and digital resources. These methodologies come under the umbrella of Educational Design Research which aims,

> to design and develop an intervention (such as programs, teaching-learning strategies and materials, products and systems) as a solution to a complex educational problem as well as to advance our knowledge about the characteristics of these interventions and the processes to design and develop them. (Plomp 2013, p. 15)

The model for educational design research is often taken from design research in engineering, akin to design science methodologies in software engineering development (Middleton et al. 2008, Bannan-Ritland 2003). The process in educational design research, as in engineering design research, is highly iterative, characterised by the prototyping of successive approximations to the solution, in collaboration with the end-users or practitioners. Formative evaluation of prototypes is central to design research processes, followed by summative or semi-summative field testing of the final design (Nieveen and Folmer 2013).

19.4 The Stages of Design and Development of Digital Learning Resources

Plomp (2013) summarises the common stages of design research, drawing on the work of a number of researchers. These are as follows:

Preliminary research: needs and context analysis, review of literature, development of a conceptual or theoretical framework for the study
Prototyping stage: iterative design phase consisting of iterations, each being a microcycle of research with formative evaluation as the most important research activity aimed at improving and refining the intervention
Assessment stage: (semi)-summative evaluation to conclude whether the solution or intervention meets the pre-determined specifications (Plomp 2013, p. 17)

The preliminary stage is sometimes characterised as constituting a feasibility study of the value, acceptability to end-users and other stakeholders, and other consequences of the intervention (Middleton et al. 2008). The context analysis or feasibility study leads to system specification, or in the case of education, 'design guidelines', also known as 'design propositions', that permit an initial model or prototype to be built (McKenney and Reeves 2012, Plomp 2013). The aim of design research is to develop a final product, artefact or materials for use in a particular context, but also to develop design principles for developing similar educational materials for use in other contexts.

This complex and highly intensive design process allows instructional designers to develop high-quality materials whose practicality, feasibility and effectiveness have been properly established (Nieveen and Folmer 2013). In the rush for digital alternatives to traditional teaching and learning methods, this aspect of the learning sciences' design process can be overlooked. With the requirements above in mind, the following sections outline two case studies that illustrate some of the considerations that need to be taken into account when developing digital solutions for educational contexts.

19.5 Case Study 1: Developing Online/Digital Learning Resources for Learning Support in Higher Education

The Science Learning Centre at the University of Limerick has offered learning support for undergraduate students having difficulties with science and engineering modules since the early 2000s. Student progression and retention are now a national priority in Irish Higher Education and are major focus of national policy in recent years (HEA 2016). A report from the Higher Education Authority found that the overall rate of non-progression (from year one to year two) was 11% for primary degrees (level 8) in universities in the year 2012/13 (HEA 2016). Student retention therefore has become a priority in the University of Limerick, in recent years, with learning supports such as those provided by the Science Learning Centre playing an important role in enhancing student success. Science and engineering students in first year are among those most at risk of failing to progress in their modules and programmes (Lane and Walshe 2019), so this support is crucial. For the most part, the Science Learning Centre supports students who may not have studied a particular subject in upper secondary school, but have to take modules in this discipline as part of their foundational learning for their degree. The main areas for which students request support are physics, chemistry and mechanical engineering. The Science Learning Centre has traditionally offered support in two main ways. Firstly, it offers support via a drop-in centre where postgraduate tutors answer student questions on an ad hoc basis. Tutors specialising in particular disciplines (physics, biochemistry, etc.) are available to the students. Secondly, the Learning Centre provides support tutorials for specific modules. The support tutorials, which are mainly provided if requested by students, are supplementary to scheduled module activities. In collaboration with the module lecturer, a postgraduate tutor who specialises in the area teaches the tutorials, with the lecturer providing course materials, indications of topics the students may find difficult, and so on.

In recent years, the development of digital learning material/activities is increasingly seen within the University of Limerick, as elsewhere, as a way to supplement the face-to-face teaching and learning support already provided (Rodrigues et al.

2019; Nortvig et al. 2018). Clearly, the use of digital learning materials has a number of advantages. Science Learning Centre staff have found that there are a number of easily identifiable concepts that students tend to find problematic year after year, for example, the concept of a mole and molarity in chemistry, or free body diagrams in physics. The use of tailored screencasts explaining such topics would give students more ways to access learning support outside of the set Drop-in or tutorial times. Screencasts would also provide the tutors with useful instructional materials for explaining these concepts to students. Other digital learning solutions that could be provided to students are specialised quiz materials for specific modules. A third option is offering online support tutorials and/or forums, as opposed to face-to-face tutorials, through the virtual learning environment.

These forms of digital learning materials and online learning are not new by any means. Screencasts, for example, have been used for some years to support student learning of specific concepts in higher education (McLoughlin and Loch 2012). However, there is now an institutional imperative to move towards digital forms of teaching and learning along with increased support, in terms of funding and, to some extent, professional expertise for the design and implementation of educational technology (Tømte et al. 2019). These and other options for online support services were being explored in the year or so up until March 2020. At that point, the only digital learning that the Science Learning Centre had actually implemented was the production of a handful of short screencasts for physics and chemistry topics, made on a pilot basis. The following section outlines some of the ways in which the Science Learning Centre responded to the university campus COVID-19 shutdown when it had of necessity to move its operations entirely online over the course of a weekend. However, it is important to make it clear that this was not the kind of carefully designed and iteratively developed process for developing online teaching and learning that is ideally required. Nonetheless, the Science Learning Centre had already been moving in the direction of increasing its online capacity, and some valuable lessons were learned about what might work best for staff and for students in the future.

In any situation where learning support is being developed, there are a number of issues that need to be addressed of both a practical and a pedagogical nature. Students who come to the Science Learning Centre Drop-in or who attend support tutorials for specific modules are not looking for generic support for physics or biology or chemistry concepts, but for specific support for their modules. Support tutorials are already designed with that in mind; however, even so, it still requires that every year the tutor interacts with the lecturer for guidance and direction on how best to deliver support, even if the same lecturer and tutor are involved as were in previous years. Curriculum and assessment in third-level is a dynamic process: lecturers may omit a topic or add a topic from year to year; the student cohort may find topic x problematic this year, and topic y last year, and so on. Individual students may have different issues with module material. The face-to-face process is by its nature interactive and responsive to module, teacher, and learner needs; digital content developed last year may not be so relevant for this year, even where focusing on exactly the same module. Then, of course, there can be several different modules dealing with exactly the same physics or chemistry concept; but with very different emphases, use of different notation, different tutorial and assessment questions relating to it, etc. One screen cast or online quiz on the topic of 2-D forces is very likely not going to satisfy the learning need of students taking all those modules; indeed potentially it might satisfy none of them.

It takes considerable investment of resources and time to design and develop digital learning materials. While enthusiasts for digital learning may believe that this is simply a matter of turning a camera on a classroom just once to capture a learning experience for ever, in practice, high- or even average-quality digital learning materials have to be developed in far more pain-staking detail than face-to-face learning, with a much higher initial investment. As they are a static resource, they may have to be updated yearly, just as physical lessons have to be taught afresh each semester, in order to be relevant and fit-for-purpose. Digital learning may have the advantage of remote accessibility, but there is no question that it could require high and ongoing investment of resources.

There are also many design issues that need to be considered. The first part of the design cycle for instructional materials is the needs analysis – this is the 'what' question: what digital learning resources will be developed and to what end? In this case, it is not difficult to identify the modules for which students most often request support. And from there, based on common topics students usually request within the learning centre, it is relatively easy to identify likely topics/concepts for which digital learning supports might be developed. Module lecturers can and should be consulted of course. This takes time, of course, but also lecturer buy-in. The next question is what kind of support should be developed; should it be a series of short screencasts; and/or quizzes; and/or a live online support tutorial? What are the advantages and disadvantages of any or all of these? Assuming the format is agreed, questions then arise of how to achieve any of this. What hardware and what software? Educational technologists may or may not be in a position to help; there may be no centrally available educational technology unit that has the capacity and remit to offer the technological expertise and support required to develop digital resources for each and every department or unit. On a related note, it was crucial that during the COVID-19 shut down, Science Learning Centre activities and resources were offered via, or housed within, the institutional VLE. Both staff and students were already familiar with use of the VLE, and in addition, there is technical support that the Science Learning Centre of which staff could avail. This was essential to ensuring reasonable continuity of services.

In summary, for the apparently most straightforward of digital learning materials – a screencast that captures a tutor or lecturer working through a science concept problem by hand, combined with some images/photographs, perhaps also including a PowerPoint presentation, along with voice-over – several different and expensive software solutions may be have to be explored and then integrated in the production stage.

Having decided on the 'what' and the 'how', the next stage of the design cycle for digital resources is very careful story boarding. A three-minute video screencast might take several hours to storyboard – that is to write out in detail each sentence that will be uttered; every image that will be used, etc. When it is being recorded, it will require perfect articulation of every line uttered, with no 'ums' or 'ahs', mistakes or digressions. While these would be passed over in a live lesson, they can appear very unprofessional in a screencast. This usually means several 'takes', and several hours of editing. Other kinds of digital learning materials may not be so time-consuming to develop in the production phase, for example, to develop an online interactive quiz based on a particular engineering lecture, so that students can check their understanding of the concepts, and can help them to retain the detail of that concept.

In the course of the COVID-19 shutdown, Science Learning Centre staff developed a range of short video screencasts on chemistry, physics, process technology and mechanical engineering topics. Teaching staff and tutors formed a community of practice around the best ways to make these videos and to teach online generally, sharing experiences and pitfalls at weekly online meetings. The development of this capacity and expertise amongst Science Learning Centre staff for the actual production process – the 'how to' of making the screencasts – is possibly the most valuable outcome in the medium term. The module lecturers are the content experts, and in most cases, they were very glad to be involved and to review the first prototypes. Students did engage with and find the videos useful, but the next step is to get systematic student feedback on these new resources – the campus shutdown was not the context in which to engage in iterative production and feedback cycles, where the end-user participation would be central. Rather, the aim was to quickly provide students who could not access synchronous support with some fallback resources in a crisis context. They are a lasting resource, which will be there for students repeating assessments and for future years. However, the videos were time-consuming to produce (even without end-user review), and some lecturers were unavailable (at an extremely pressurised time of crisis in higher education) to engage in the process. Quality control and production values are very difficult to standardise in a crisis context, and it is likely that some videos will have to be re-recorded. Nonetheless, they represent good first prototypes.

In short, instructional materials should be formatively and summatively evaluated to ensure their quality and their effectiveness as a learning support. Focus groups, expert review, pre–post concept tests are typically used to evaluate exemplar materials developed in the iterative prototyping phase, before utilising large-scale quasi-experimental designs (comparing the experimental and control groups) in the stage of field testing (Nieveen and Folmer 2013). This kind of iterative evaluation is expensive, time-consuming and resource-heavy, but it does confer some measure of validity and reliability on any future materials developed using the same protocols.

Another digital solution is the provision of live or synchronous online support tutorials. This permits remote access to support on the part of learners, and if not being recorded, it does not require the kind of careful storyboarding of a recorded screencast. This was the main form of online support offered by the Science Learning Centre during the COVID-19 shutdown of face-to-face support services. There are however, significant issues to be considered regarding the accessibility of synchronous online lessons for students. The involuntary wholesale transition to online learning and support during the COVID-19 shutdown highlighted that online learning can exacerbate underlying socio-economic inequalities amongst students. It became evident very quickly that students may have neither adequate broadband, hardware, nor indeed a quiet space at home where they can engage in online learning (Nordmann et al. 2020). To help ameliorate this, the Science Learning Centre provided both synchronous live classes, and asynchronous follow-up resources for students who could not access these (notes from live classes, short videos and web links, etc.), which certainly helped some students.

There can be other disadvantages for students of online versus face-to-face delivery of tutorials. Science and engineering tutorials tend to be concerned with working through numerical problems, and this does not lend itself to pre-prepared PowerPoint presentations. Tutors experimented with using digitising pads and pens, or webcams pointed at pen and paper, and with a variety of software (OneNote or other digital whiteboards, compatible with the VLE) to find the option that worked best for them and for the students. Pedagogically, online support could potentially be more teacher-centred; with less opportunity for, for example, small group work in class. The remoteness and detachment of the medium can be off-putting to some learners, and inhibit deep engagement in the learning process, such as building an identity as a science learner (Nordmann et al. 2020). Tutors found that students could be very reluctant to engage via either audio or chat functions, particularly if the support tutorial was being recorded for those who could not engage synchronously. Break-out rooms within the VLE classrooms helped to encourage active participation of some students in online tutorials, probably because they were not recorded, and were composed of small groups, but tutors need a bit of practice in how to manage these. It was therefore a trial-and-error process for tutors, as they encountered various pedagogical and practical differences between face-to-face and online teaching.

In general, attendance at online support tutorials was comparable to attendance with the face-to-face versions of the tutorials before the shutdown. However, there was a huge decrease in students attending 'drop-in' sessions online. It is unclear why students engaged less in this more individualised form of learning support, as student feedback was not very forthcoming on this. It can be speculated that for some the psychological security provided by one-to-one or small group tuition in a relatively private physical space is not experienced in the same way in an online format. This aspect of the Science Learning Centre support provision would need to be designed and planned with a good deal of student input, if it were to be implemented online in future.

In summary, digital learning materials can indeed be a very useful part of a suite of pedagogical tools used within a module, or within a Learning Centre, and particularly where there are students taking the module who have accessibility limitations. However, they will not be easy or cheap to produce, if they are to be of good quality. Like all instructional materials, they will need to be redesigned and updated on a very regular basis if they are to remain relevant. From a learning support perspective, their main advantage is accessibility; however, from the perspective of student-centredness, they may not be as flexible and as responsive to student need, depending on the format in use. Likewise, online synchronous classes can work well as a way to offer digital learning support, but they will not be accessible to those without good internet connections; and pedagogically and practically, they are quite a different experience for both teachers and for learners.

19.6 Case Study 2: Developing Video/Online Resources to Support an Outreach Project

The section outlines the considerations that need to be addressed in the development of digital resources for an outreach project. The SOPHia project was developed by the Department of Physics and the Science Learning Centre at the University of Limerick, with the support of the Institute of Physics in Ireland. There is a three-to-one ratio of male-to-female students taking physics at Leaving Certificate level (upper second-level at school) in Ireland. This has a knock-on effect on the number of women taking physics in higher education, and ultimately in senior roles in academia and industry. SOPHia was developed by the Department of Physics in order to address this gender imbalance, starting as a small pilot in 2017/18. Following a successful launch, the SOPHia Project was funded by Science Foundation Ireland (SFI), under its Discover Programme call. The main activity in the project is a school visit programme to encourage female students to study physics at upper second-level in school. Undergraduate physics students visit schools and deliver a workshop to female lower-second level students. The workshop consists of demonstrations and information about physics, and emphasises a sense of belonging, endorses effort and hard work over brilliance, and combats the stereotypes of who does physics. Students' awareness is raised about gender stereotypes, and of the contribution physics makes to their lives. The undergraduate facilitators tell their own story of how they came to study physics, and serve as role models for the school students.

Other project activities include a student competition for projects researching famous physicists/important physics discoveries/local physics, and a showcase event to inform teachers of the issues with regard to gender in physics. An interactive website for parents, teachers and students aims to supplement the school visit programme, with curriculum-linked activities.

The project has grown exponentially from being an initially small pilot consisting of occasional school visits, to a large-scale intensive and extensive programme of activities. The school visits are popular with schools and teachers, because they help them to address the problem of uptake of physics, and they have been found to be having a positive impact on participants. Of 310 student surveys analysed from 7 school visits undertaken in the spring semester of 2019, the trend was increased positive perceptions of physics following student participation in the workshop. For example, with regard to knowledge of physics role models, on a five point scale (from 1 – not at all to 5 – very much), the mode rating was 1 before (54% of respondents) but was 4 afterwards (29%). Similarly, there was a 58% increase in those who said 'maybe' and a 44% increase in those who said 'yes', regarding their intention to choose physics as a subject at upper second-level (Walshe et al. 2019). The increase in demand for school visits presents the project with problems of scale. The visits are labour-intensive, requiring the availability of two undergraduates facilitators during the semester, when they have a full schedule of lectures. The geographical areas targeted extend from the south-west to east-midlands of Ireland, encompassing schools within a 200-km radius of the university. Some of the school visits require a day of travel there and back. Therefore, there is a limit on the number of schools that can be visited. There is a clear case for having an online version of a workshop, perhaps hosted on the website. While the face-to-face nature of the school visit, with audience interaction, cannot be paralleled by a video, it would be good to offer something teachers could show to their students as they came to choose their subject options.

What are the issues with respect to converting a face-to-face workshop to an online resource? The first is making sure that it is appropriate for the target audiences. The workshop is currently delivered to students from ages 9 to 16, and is adapted accordingly, and fairly easily. New versions of the workshop are being developed for different cohorts of students all the time, for example, it is going to be adapted for the interests of students coming from urban schools, so it is relevant to their context. It is a co-creatively designed workshop: every pair of facilitators brings their own stamp to the workshop they deliver, and this is part of its power as an outreach model. However, one static online resource would not do this so well. It is likely that two or more online/digital versions would have to be developed: one aimed at younger students and the other at older age groups. Even with that, the interactive parts of the workshop – the questions thrown out to the audience, the participation of the students in the demos – cannot be replicated in a digital version. In other words, simply making a video recording of a live workshop is highly unlikely to be effective as an online resource. The same design principles that inform the school workshop, therefore, need to be incorporated into a quite different online replacement resource.

Other considerations that must be addressed are how to make the school student workshop accessible, and how to measure its impact if and when it is sourced by a school or an individual student. If it is simply made freely available to all on the website, how will it be determined who watches it, their gender and some other basic demographics such as school level, and whether it has had an impact on their perceptions and intentions with regard to physics? It is known that the live version of the workshop is effective. A poorly designed online version could in fact deter students from pursuing physics, or reinforce negative perceptions, inadvertently. Or, more likely, it could sit on the website and never be watched, and therefore have no effect, one way or the other. How can we know if it might have such unintended consequences? This is where the need for educational design research is crystal clear in ensuring a high-quality online resource that has been formatively and summatively evaluated in collaboration with end-users (students), teachers and other stake-holders. A badly designed 'digital solution' could have the effect of undoing the otherwise very good impact of project activities. As Moller et al. (2008) point with respect to moving classroom learning online, taking what works in face-to-face situations and merely duplicating it online can lead to limited positive results. Even once a high-quality resource has been developed, measuring its impact becomes difficult. Currently, students are asked to complete short surveys before and after attending the workshop (with parental consent), teachers are asked to fill in a feedback survey, and schools are followed-up on the numbers of students who take physics as a subject. It is unclear how this type of intensive evaluation could be replicated for an online version of the resource, unless access to it is made contingent on providing such feedback. This may be the solution, but it obviously limits incidental viewings of the resource.

However, the SOPHia project website has proven to be a very useful way to disseminate project information, support the live events, and to offer teachers some educational materials that further the project aims. It presents information on a range of female physicists, linking their research to the Irish lower-second-level curriculum. There is also a blog on the physics of beekeeping, making the link between physics and the environment in an engaging way. Teachers have reported back on finding this very useful – many of them know very little about women in physics, or about physics and the environment. During the COVID-19 shutdown, while it was not possible to visit schools, it was possible to provide some support for parents and for teachers now working from home, by developing some more online activities, specifically curriculum-linked materials aimed at primary-level students. Normally, teachers and schools would have been asked to register to be given access, in order to be able to gauge their reach, to collect some basic feedback on their usefulness as a classroom resource, and to gather some information on the school levels they are being used at. This will happen at a later stage. As part of the package of SOPHia activities, the intention is that these worksheets and lesson materials will support teachers to engage more young people in physics. Here the advantage of digital learning resources can be seen; some relatively small-scale tailored resources can be made easily and cheaply available to all. The worksheets will be useful to teachers in the classroom, but they are not attempting to replace the outreach activities, but rather to support and supplement them.

19.7 Conclusion

This chapter has considered the affordances and constraints of developing digital resources within two very different contexts: firstly to enhance science and engineering student support services within a university, and secondly to enhance the audience reach of an outreach project to promote physics to school students. There may be a misguided perception amongst some in the education sector that providing digital solutions is an easy option, and/or that they will be a cheaper option than discipline-specific real-time and real-life teaching and outreach expertise. There is no doubt that provision of online digital resources, such as worksheets, screencasts and quiz materials can enhance accessibility of learning and can be a very useful adjunct to face-to-face activities of various kinds (Arkorful and Abaidoo 2015). They can support and permit students to engage in autonomous out-of-class learning. Given sufficient high levels of content and pedagogical expertise, high levels of (ongoing) technical and administrative support, the necessary software and hardware, considerable time for iterative development and re-development of digital materials, and the buy-in of all curriculum stakeholders, excellent online digital solutions can be developed (Nortvig et al. 2018). But in many cases, this level of resourcing is not available, and even where it is, that does not mean that digital learning solutions, on their own, will provide the best outcome for students (Dumford and Miller 2018). While the COVID-19 pandemic led to an overnight transition to online teaching and learning across the education sector, in the longer term, this extreme version of an external process driving digitalisation would have to be mediated by internal processes for good teaching and learning outcomes to occur (Tømte et al. 2019). This will be dependent on staff preparedness, student preparedness and system capacity issues. The most important criteria for using digital learning solutions is purposeful implementation, that is, that they are designed for a particular purpose or outcome that already exists (Willis et al. 2019). As the case studies here have illustrated, digital materials, while providing the solution to some problems, may raise others; and for curriculum designers and outreach providers there is therefore always a balance to be struck when considering how best to design and deploy them.

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Chapter 20
Comparative Judgment: An Overview

Eva Hartell and Jeffrey Buckley

20.1 Introduction

The potential for the digitalization of assessment is immense. However, most digital assessment tools rely on traditional means of assessing student achievement instead of adding value to student learning and/or reducing teacher workload. Comparative judgment (CJ) on the other hand has been proven to be a valid, reliable and efficient method of assessing open-ended tasks in a variety of subject areas (Bartholomew and Yoshikawa-Ruesch 2018; Jones et al. 2015; Pollitt 2012a, b; Seery et al. 2012; The Royal Society 2016) and offers significant formative opportunity (Bartholomew et al. 2019; Seery et al. 2019). In contrast to traditional criterion referenced assessment, the CJ process is premised on pairwise comparisons. Cohorts of assessors are individually presented with pairs of portfolios[1] of student work from which they must select the "better" of the two. By doing this, the question an assessor needs to ask themselves when evaluating student work is changed from asking what mark should be given relative to a criterion to which of the two portfolios in front of them provides more evidence of capability or learning. Based on research to date, which will be discussed in this chapter, it appears that this second question can be answered more reliably. In practice, the pairwise decisions made within the CJ process have

[1] The term "portfolio" will be used broadly throughout this chapter to describe all manners of student work (e.g., design outputs, essays, etc.) which could be included for assessment through CJ.

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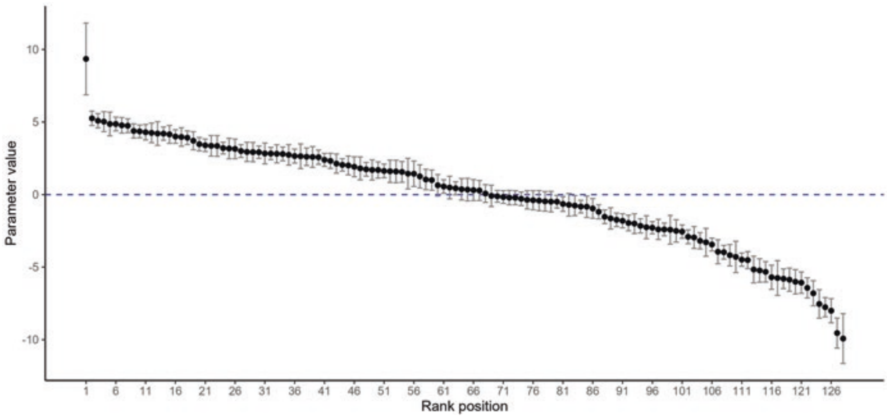

Fig. 20.1 Output of a CJ session based on data from Seery and Buckley (2016). Each data point represents one portfolio. The x-axis describes rank position and the y-axis describes relative performance in terms of parameter values (*z*-scores). Error bars represent standard error

generally been holistic, based on assessor expertise and prior experience; however, it is feasible for external criteria to be provided to guide these judgments (e.g., Bartholomew et al. 2018b; Mortier et al. 2015). After a number of rounds of judgments, the result of this process is a rank order of the included portfolios, with relative distances (parameter values) between portfolios based on the assessors' judgments (Fig. 20.1). Thus, the validity of the process is directly tied to the cohort of assessors (Lesterhuis 2018). Critically, there are no absolute indicators of quality such as grades inherent within the rank. The highest ranking portfolio may not necessarily be of high quality, and the lowest ranking portfolio may not necessarily be of low quality, they are just ranked as best and worst relative to all portfolios, which were included in the CJ session. The transposal of the rank to, for example, percentages or grades can be achieved after the CJ process through a variety of methods if desired based on the agenda of the assessment.

An individual assessor can undertake this process of pairwise comparisons with the work of their own students independent of a digital solution. For example, a teacher could pick two random essays from their pile of student work, compare them, and identify one as better, then repeat the process iteratively until a rank of quality from the pile is determined. Digital tools which have been developed to support the CJ process such as No More Marking (2020) and RM Compare (2020) do this by providing detailed reports of outcomes, managing the selection of portfolios to present for comparison, and by facilitating collaborative practices among teachers and schools which can occur both nationally and internationally (see Bartholomew et al. 2019, for an example of an international cohort of judges). A direct result of this digital facilitation is that CJ is most commonly undertaken by several assessors who independently complete the series of pairwise comparisons, which results in the outputted rank. According to Pollitt (2012b), this holistic approach embedded in CJ with multiple judges rules out personal biases, leading to higher consistency in judgment among the assessors.

CJ has emerged quite recently in various educational subjects, such as Modern Languages, Design and Technology, Music, Mathematics, and Geography, and at various levels of education ranging from primary level to higher education in different parts of the world. It was first used by Pollitt and Murray (1993) in the assessment of a foreign language-speaking assessment. This was followed by further use by Pollitt (2012b) with English-writing scripts and was adopted for use in other subject areas such as Design and Technology education by Technology Education Research Unit (TERU) at Goldsmiths, University of London (Kimbell 2012; Kimbell et al. 2009). While it was first used primarily for summative purposes, as it was integrated in more educational settings such as technology education (Bartholomew et al. 2018a; Hartell 2018; Kimbell et al. 2005, 2007, 2009; Seery et al. 2012; Seery and Canty 2017; Stables and Lawler 2012), mathematics (Jones and Inglis 2015), and geography (Whitehouse 2013; Whitehouse and Pollitt 2012), there was a shift toward using CJ formatively. Since the pioneering work of Pollitt, CJ has also been further refined as a tool for assessing student writing (Coertjens et al. 2017; van Daal et al. 2019; Jones and Wheadon 2015; Lesterhuis et al. 2018; Steedle and Ferrara 2016).

In providing an overview of the use of CJ in education, the following sections of this chapter will discuss the underpinning theory of CJ, present examples of its use in education, synthesize criteria for the successful incorporation of CJ for educational assessment, and discuss future possibilities for the use of CJ in terms of research and practice. The chapter will not discuss technical information or suggest particular software to use; instead, it provides illustrative examples to inspire readers to try to embed it in their own context. Most of the examples provided in this chapter are taken from the STEM context, in particular, technology and engineering, due to the relatively high volume of CJ studies in these areas. However, it is important to note that CJ as a process is transferable to any context, at least in which the student work being assessed was generated in response to an open-ended task, and it has and continues to be used in other subject areas such as English, Mathematics, and Geography.

20.2 A Primer on the Underpinning Theory of Comparative Judgment

The pairwise comparison methodology inherent to CJ was first adapted in the 1920s by the American psychologist Luis Leon Thurstone in his quest to find reliable measures of people's attitudes about the seriousness of various crimes (Thurstone 1927). Thurstone argued that people found it difficult to describe how serious a crime is, especially in absolute terms. Instead, he asked them to compare two crimes and then judge which one was more serious. From this work he formulated the *Law of Comparative Judgment*, which essentially says that people are more reliable when comparing two stimuli, such as two crimes, than when giving an absolute value to a stimulus. However, it is arguable that the history of CJ predates Thurstone, as making such pairwise comparisons is something that humankind does across many aspects of day-to-day life. For example, when posed with multiple options of what to eat for dinner, what clothes to wear, what to watch on TV, or when choosing a perfume they prefer, people are engaging with a decision-making process similar to that which underpins the use of CJ for educational assessment. Indeed, Laming (2003) built on Thurstone's work and concluded that all assessment is a comparison of one thing to something else, arguing that absolute judgment is not possible. This was corroborated by Gill and Bramley (2013), who found that assessors made more accurate judgments when making relative rather than absolute assessments and that assessors felt more confident using the comparative approach than assessing texts absolutely by using scores or rubrics.

Central to CJ is the idea that two stimuli (such as portfolios of student work) must cause a reaction in the observer. These differences in reactions to the two stimuli are called *just-noticeable differences* (Thurstone 1927). From these, the observer formulates a judgment about the relationship between the two stimuli, such as the seriousness of two crimes or the best perfume scent. To provide an example of this process, Fig. 20.2 shows an example of two pieces of student work, in this case pictures of sunflowers, from an assessor's perspective in the RM Compare CJ digital solution. As an assessor, if the assessment was about which piece of artwork shows greater evidence of capability, you would be tasked with reflecting on the just-noticeable differences you experienced between the two in order to make your decision. Once you have made a decision, you would select each option A or B as the winner, and be presented with a further two pieces of work to compare. Importantly, in the arts there are personal preferences whereas in art education there are certain concepts that needs to be taught and practiced. Therefore, judgments and comments relating to the student work in Fig. 20.2 cannot just be

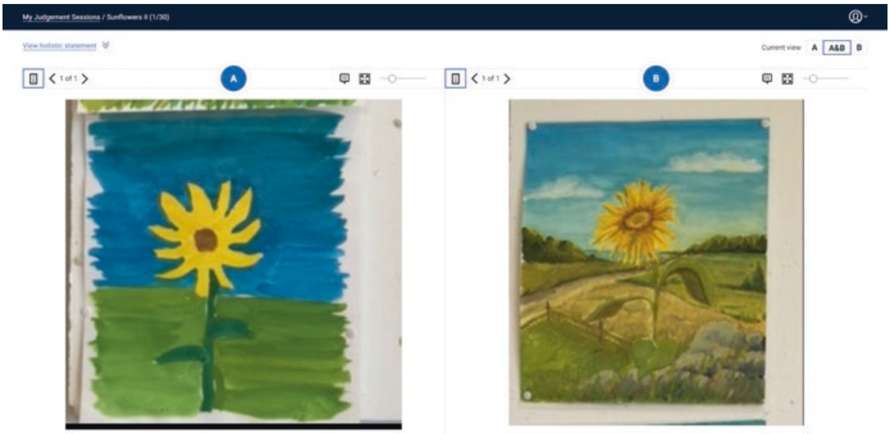

Fig. 20.2 Example of two pieces of student work presented for a pairwise comparison in the RM Compare digital CJ solution

personal opinions. Instead they should be tied to the context and circumstances in which these sunflowers are undertaken.

Beyond the judgment of a piece of student work as better or worse, a second important aspect of CJ is the approach to selecting which two pieces of work to present to an assessor at a given time. This is generally managed by a digital solution. A central mechanism for this is the *Swiss tournament* approach. In this, the first round involves portfolios being paired randomly, with the results of each judgment being that one portfolio wins and the other loses. Following this, in a Swiss tournament, pairing is conducted by selecting two portfolios with the same number of wins to be compared. Here, an important distinction must be made between CJ and adaptive comparative judgment (ACJ). Both are founded on the same principles, but in ACJ, the adaptive element relates to an algorithm (generally propriety so not disclosed in peer reviewed outputs) that presents two pieces of work to an assessor based on outcomes of the judgments made so far. In ACJ, after a number of rounds following the Swiss tournament method, the new adaptive algorithm is used to select the portfolios to present to assessors. In other words, the experience of the assessor is common in both CJ and ACJ, but ACJ was designed to be more efficient by reducing the number of judgments to be made by not presenting portfolios where the outcome is almost certain (Bramley and Wheadon 2015; Pollitt 2012b).

20.3 Reviewing the Use of Comparative Judgment in Education

Prior to exploring examples of the use of CJ methods in education, it is worth noting two often cited benefits of CJ over traditional methods of assessment. This first comes in response to the difficulties that emerge when trying to achieve high levels of reliability in the assessment of student work produced in response to an open-ended task. In practice, many teachers start this process by roughly sorting student portfolios in order to get a sense of levels and indicators of quality. This process may be undertaken more or less tacitly and more or less systematically. Whilst teachers can often identify levels and indicators of quality in student work, how reliable their judgments are with respect to assigning grades relative to these indicators in comparison to the judgments other teachers would make needs to be considered. By having cohorts of teachers' act as assessors, the CJ process has repeatedly seen high levels of reliability, usually with cohort agreement levels being greater than 90% (see Bartholomew and Yoshikawa-Ruesch 2018, for a summary). Indeed, a repeatedly purported strength of CJ is that it rules out personal standards and biases due to the involvement of several assessors. Where one assessor may hold certain views on what denotes capability, another may hold a slightly different construct of capability. Thinking back to the sunflowers presented in Fig. 20.2, one person might suggest flower B as better evidence of capability due to the increased level of detail where another could appreciate the minimalist rendering of flower A. The final outcome (the relative rank order of portfolios) when using CJ is the result of all the judgments made by all the assessors involved, not just one assessor as would usually be the case in traditional criterion referenced assessment. Thus, the outputted relative rank order of portfolios represents a shared consensus of the particular competence of all the assessors where individual biases are mitigated by the inclusion of multiple perspectives of quality.

Aside from reliability, a second suggested benefit of CJ relates to time. Some studies suggest CJ can take less time than traditional grading to assess student work (Newhouse 2014; Steedle and Ferrara 2016). However, evidence associated with time implications is mixed with others, suggesting traditional grading takes less time (Bartholomew et al. 2018c) and others suggesting comparable time requirements for both approaches (Coertjens et al. 2017). In this regard, CJ is apparently not a silver bullet; it needs both practice and consideration in terms of the time it take to set up a judging sessions, assessment times are likely to be significantly impacted by other variables such as the complexity of the assessment rubric in traditional assessment, assessor expertise, and the nature of the student work, and the time commitments of all assessors needs to be considered (Buckley et al. 2020).

20.3.1 Illustrative Example of a Comparison Between CJ and Criterion-Referenced Assessment

Even if the evidence is there, the complexity of embedding new models of assessment must be based on several factors, including compatibility with existing methods based on their relative advantages and utility. A group of researchers at Purdue University undertook an exploratory study to examine ACJ in comparison with traditional assessment methods in terms of validity, reliability, and utility in the context of engineering education (Bartholomew et al. 2018b). In their study, a group of 16 undergraduate engineering students completed an engineering design challenge in response to an open-ended brief. Their work was then assessed by the course instructor using a traditional rubric, and a group of five independent experts (experienced in teaching engineering design) using ACJ. The assessors who used ACJ were asked to make holistic decisions based on their own professional opinion, but were aware of the criteria specified in the traditional rubric.

A very high level of reliability ($\alpha = 0.95$) was observed from the ACJ process and the researchers found strong a correlation ($\rho = -0.79$, $p < 0.01$) between the grades awarded via the traditional rubric assessment method and the ACJ rank. Note that the correlation was negative as lower values in the rank indicate better performance, that is, first place versus second place. This was interpreted to suggest that ACJ is a valid, reliable, and comparable tool to traditional assessment methods. Importantly, by using the correlation between ACJ and traditional assessment as evidence, this approach to interpreting ACJ being valid is based on the assumption that the traditional assessment method it is being compared to is also valid, and a limitation exists in this study in the researchers using the ACJ rank order in their analyses instead of the parameter values which denote relative performance between portfolios. While the parameter values and rank order will be very strongly correlated, as the rank is a direct product of the parameter values, by not reflecting relative performance, the rank only offers a simplified understanding of the outcomes. Interestingly in this study, neither the results of ACJ nor the traditional assessment were significantly correlated with the actual performance of the student's design. Therefore, the authors noted that it might be time to question the current methods of assessing process instead of the actual performance of the final product/prototype.

Two further studies have compared CJ with traditional assessment practices. Jones and Inglis (2015), where secondary school level mathematics problems were the subject of assessment, found a strong correlation ($r = 0.89$) between CJ parameter values and predicted General Certificate of Secondary Education (GCSE) grades in the UK. They also found that when CJ was the intended mode of assessment, examination scriptwriters designed math assessments to be less structured and more problem-based than was typical of standard assessment papers. Coertjens et al. (2017) also conducted a study whereby they compared the use of CJ to traditional rubrics; however, they looked more specifically at the time taken by assessors in each method. The participants in their study were in high school, and the assessments were conducted on their responses to a writing task. The researchers found that the time taken by assessors decreased as they made more pairwise comparisons or as they gained experience using the rubric, but added another important caveat to consider; it is important to see if conclusions from comparative studies such as these are transferable to other types of student work and when different rubrics are used.

20.3.2 Illustrative Example Focusing on Unpacking Learning Intentions and Criteria for Success

Every student benefits when taught by teachers who are transparent about learning intentions and criteria for success. This practice will benefit all students, especially low achievers (Jönsson 2010). An awareness of the criteria for success instills a sense of security among students which is beneficial to learning (Bandura 1997). However, students' perceptions of learning intentions may not match teachers' expectations. Further, as professionals' teachers should strive to achieve consensus in their interpretations of learning and competency. Harrison (2009) stresses the need and importance for teachers to both plan and share assessment procedures with other professionals with Pettersson (2009) stressing this even more and warning that teachers are in risk of becoming misaligned with current regulations if they do not have access to professional discussions. CJ offers a potential solution to act as a mediator for these discussions by using pairwise comparisons as a stimulus to support teachers in articulating their thoughts. A clear example of how this can be achieved is demonstrable through a study conducted by Hartell and Skogh (2015).

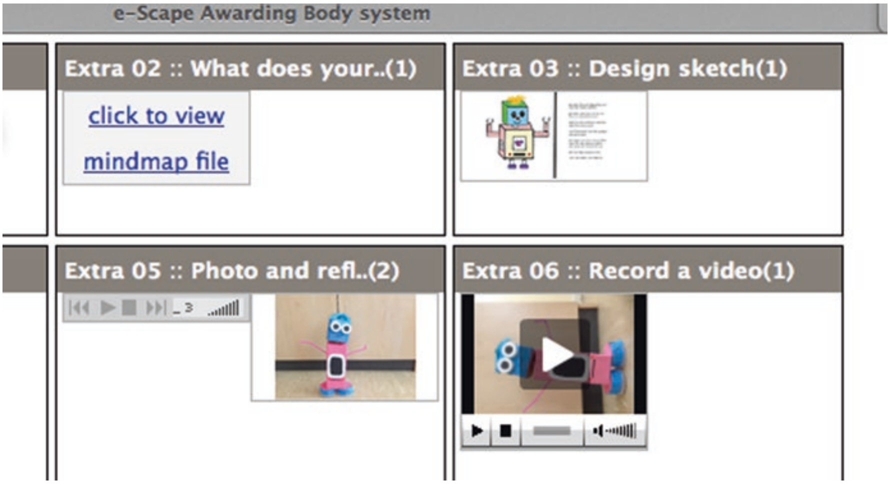

Fig. 20.3 Illustrative example of a student's online portfolio in e-scape

Using CJ, Hartell and Skogh (2015) undertook a study in a Swedish primary school context with the purpose of understanding what teachers value as criteria for success. Hartell (2013) had previously found that teachers gathered their evidence of learning during classroom activities, which is aligned with previous research in technology education (Bjurulf 2008; Kimbell 2007). In their study, teachers were asked to assess students' work under authentic classroom conditions. Twenty-one pupils in year 5 (average age ≈ 11) were tasked with designing and building a model of a robot friend which was capable of helping them in the home with particular actions. The pupils developed multimodal portfolios using iPads to capture evidence of their learning. This evidence consisted of voice recordings, sketches, videos, written text, mind maps, and technical drawings, and was consolidated within the e-scape CJ software (Fig. 20.3).

Five teachers then assessed these portfolios using CJ, resulting in a rank order with very high reliability ($\alpha = 0.93$). While they were judging the students' work they were asked to verbally provide reasons for the judgments they made through a think-aloud protocol. The analysis showed that these teachers all agreed on the importance of the narrative of the design process. They also questioned whether this had been communicated to all the students or whether some students had figured it out for themselves. The study also concluded that assessors value students' finishing their task, primarily to provide the narrative in the portfolios and in addition they wanted students to find value in finishing what they had set out to do, thereby emphasizing the importance of providing sufficient time and instruction.

This example shows how CJ, by requiring assessors to articulate indicators of quality using pairwise comparisons as a stimulus, can be used to unpack what teachers' value as criteria for success and then create a basis for professional collective discussions. A more recent study had a similar aim but for undergraduate students in a teacher education degree program. Buckley et al. (2020) conducted a study

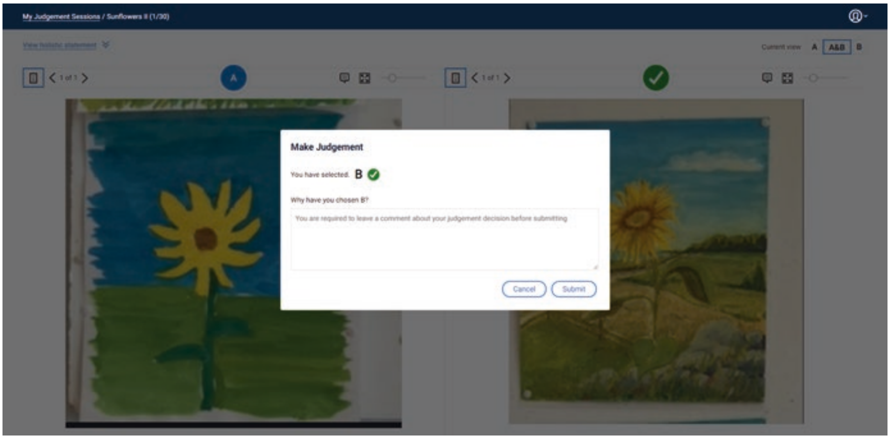

Fig. 20.4 Example of leaving of comment after making a pairwise comparison in RM Compare

whereby the students completed an open-ended design task requiring them to design and make a flower which conveyed an emotion but which had no face, and an accompanying pictorial scene. No assessment criteria were provided, instead the students themselves acted as assessors in an ACJ session once they had all completed the task. The ACJ software solution used had the capacity for students to leave text-based commentary after each judgment explaining the reason behind their decision (see Fig. 20.4 for an example of this functionality). From this, it was possible for the criteria being used to make decisions, and thus the features of the students' portfolios, which denoted quality and evidence of learning, to be identified.

This in itself offers a further layer of understanding of students learning beyond what can be seen in the outputs from a task. From a pedagogical perspective such an activity could be used to stimulate discussion between teachers and/or students on what should evidence of learning look like within a task or across a topic/unit of learning.

20.3.3 *Illustrative Examples of Feedback Facilitated by Comparative Judgment*

Feedback is put forward as critical in education. Unfortunately, feedback is often misinterpreted as any kind of information provided to learners. There is a strong body of evidence showing that feedback can cater to student learning but can also hamper learning when focused on personal traits instead of process and effort, causing lower self-esteem instead of promoting learning (Wiliam 2006). CJ does not provide feedback to learners per se. Knowing one's place in the ranking is not particularly helpful, especially at the end of learning. As noted, some software solutions enable writing comments while judging which can be fed back to learners as

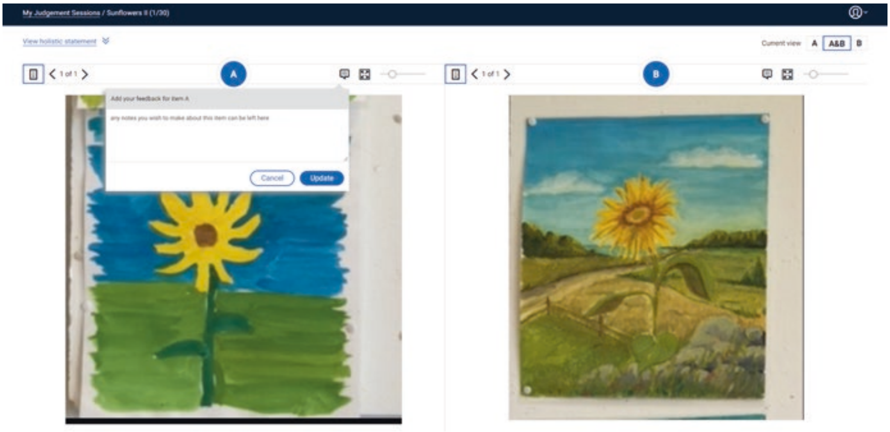

Fig. 20.5 Example of leaving of comment on a piece of student work as feedback whilst making a pairwise comparison in RM Compare

feedback (see Fig. 20.5 for an example of this functionality). This section provides three examples of how CJ can be used as a feedback mechanism either through the provision of such comments, or through simply engaging with the act of making comparative judgments on the work of peers.

In 2015, a group of Belgian researchers examined CJ as an alternative method for peer assessment of competences in the context of argumentative writing (Mortier et al. 2015). They focused their research on students' attitudes toward feedback provided, which included their position on the rank relative to their classmates and to an expertly derived benchmark. Specifically, the students' comments on the perceived honesty, relevance, and trustworthiness of the feedback as well as the importance of specific advice received from the CJ-based feedback. The researchers found that students did find the feedback to be reliable, relevant, and honest. The students appreciated personalized tips on how to improve being included in the feedback report along with the quantitative measure showing how they had performed relative to peers and the benchmark. The authors concluded that "CJ-based feedback is a potential fruitful way to ameliorate students learning" (p. 79), and were hopeful that their work would encourage further investigation into the potential of CJ as a feedback tool.

The work of Mortier et al. (2015) did indeed inspire further research on CJ and feedback. A recent study by Seery et al. (2019) explored whether the act of making comparative judgments on peers work alone could act as a useful feedback mechanism. In their study, a group of 136 undergraduate students in a design and communication graphics module completed four consecutive graphics design tasks. Each task was followed by an ACJ session, where the students acted as the judges of the outputs produced in response to the task. In other words, the students completed a design task, assessed it through ACJ, and then began the next design task, in a process that repeated for four design tasks. Performance in the first task was used as a benchmark, and students were grouped into quartiles based on this performance. The only form of feedback received by students was their exposure to the work of their peers by having to make pairwise comparisons through the ACJ process. The results of this study were that the poorest performing students (quartile 1) in the initial task saw a mean increase of 41% between the first and fourth tasks, the students in the second quartile saw a mean increase of 28% between the first and fourth tasks, the students in the third quartile saw a mean increase of 19% between the first and fourth tasks, and the top performing students initially (quartile 4) actually saw a mean decrease of 1% between these tasks. The researchers interpreted these results as poorer performing students initially having more room for improvement over time relative to initially higher performing students due to a potential ceiling effect, and through the ACJ process, poorer performing students were likely to be exposed to work of a higher standard and thus were receiving better quality feedback in comparison to students who were initially highest performing who were more likely to be comparing work of a poorer standard to their own.

A similar investigation into the use of CJ as an assessment tool was undertaken by a group of researchers at Purdue University (Bartholomew et al. 2019). In their study, four class groups of middle school students (12–13 years old) in the US engaged with a learning activity requiring them to research, design, and produce a travel brochure for a location of their choice in Southeast Asia. A total of 10 class periods were afforded for this. After five class periods, the research team divided the students into two groups. Two class groups became the control group who printed their draft brochures and engaged in a peer feedback session. The other two class groups became the experimental group who, at this midpoint in their assignment, engaged with an ACJ session. In addition to making pairwise comparisons, students in the experimental group using ACJ were also asked provide feedback on how the work could be improved in the comment sections for each portfolio they were judging, an act which itself has evidence indicating it is a valuable learning activity (McConlogue 2015; van Popta et al. 2017). After receiving their feedback, all students were asked to continue and complete their assignments. Once all of the design tasks were completed, the researchers consolidated the work of the experimental and control groups and an ACJ session was performed with all portfolios with the students and their teacher acting as judges. The result of this final ACJ session was a highly reliable rank ($\alpha = 0.96$). The researchers then compared the average position on the ACJ rank between the experimental group and control group and found a statistically significant difference indicating that the experimental group outperformed the control group at the end. While this study does have limitations such as not controlling for baseline competency and comparing rank position rather than parameter values, the results do suggest potential for ACJ as a feedback mechanism, possibly due to the added value students received from exposure to and having to make pairwise comparisons on the work of peers which is in addition to giving and receiving written or oral feedback.

In these examples, it is interesting to see the combination of CJ and the provision of written feedback, as beyond traditional feedback mechanisms this includes student exposure to a wide range of work, having to choose the better of two portfolios and then being forced to comment on why they make particular judgments. Benefits from this may be the result of the *worked example* effect (Sweller 2006), wherein the students are exposed to other students' work and they can then base their own work on what to do and what not to do. This, in combination with providing and receiving peer feedback in an anonymous environment should be investigated further. Even though CJ has limitations (in particular technical and cost implications) there appears significant potential to support learning. As noted by Bartholomew et al. (2019, p. 381), "ACJ may be a potent tool for solidifying student perceptions of quality".

As a final comment on commentary feedback in these studies, it is important to remember that feedback can be shallow and not focused or aligned with the task or learning outcomes. The students in these examples were not trained in feedback or in the use of CJ, and therefore future-related research should consider the quality of feedback provided so as to identify more clearly what benefits, if any, stem from the CJ process.

20.4 Assessors in Comparative Judgment as the Most Important Component for Successful Implementation in the Classroom

Undoubtedly, CJ offers a solution for very reliable assessment. It also enables remote assessment so the cohort of assessors is not geographically restricted and it is possible that engaging students as judges in CJ sessions can have positive educational implications. Implementing CJ, insofar as setting up and running a judging session, is also not difficult. The question becomes what makes a CJ session valuable, and therefore the "successful" implementation of CJ would be characterized differently depending on whether the agenda was summative or formative. Arguably, in either case the primary consideration is who is involved in making the judgments. If the goal is to expose students to the work of their peers as in Seery et al. (2019), then the students themselves can act as judges. If the goal is to describe quality or provide feedback from the perspective of experts as in Mortier et al. (2015), the design of the assessor cohort becomes more complicated.

By way of example, a Swedish–American team of researchers, Bartholomew et al. (2020), asked groups of judges from Sweden ($n = 9$), Ireland, and the UK ($n = 7$), and the US ($n = 5$) to identify criteria for success by using a design similar to that used in Hartell and Skogh (2015). Judges were asked to compare and assess student work through ACJ and provide comments on why they chose one output over another. The judges were assessing 175 design portfolios (focusing on the design process) and 175 products (as a result of this design process) from 760 American secondary students (aged 13–14). The students had worked in small groups to design travel-friendly pill dispensers. Each group of judges engaged with two ACJ sessions, one for the students' design portfolios and one for the products, meaning a total of six ACJ sessions were conducted. Each session had a high level of reliability ($\alpha > 0.95$) indicating that within each group there was a high level of agreement. However, there were clearly differences between groups in what they valued as criteria for success.

Only one of the students' prototypes was in the top 10 of the ranks from each cohort of judges (three prototypes were in two of the top ten ranks), and similarly only one of the design portfolios was in the top 10 from each rank (two portfolios were in two of the top ten ranks). The judges' comments were analyzed qualitatively to elicit valuable insights into cultural differences. Where the Americans and the Swedes focused on usability, size, and design, the UK and Irish judges also declared innovation as important. The Swedes emphasized communication; the judges wanted to see whether the students could communicate the process, results, and conclusions, that is, the narrative. Judges from the UK and Irish group focused on the process; how developed the portfolios were or how well they demonstrated progress in design. The comments from the US-based group revealed their focus on students fulfilling the task, following the criteria and constraints; that is, how well they had completed their portfolios. From one perspective, this study emphasizes one of the strengths of CJ. People will hold different perspectives on evidence of learning and CJ offers the potential to design an assessment cohort consisting of people who hold such different perspectives. On the other hand, it needs to be considered what perspectives are valid. For example, narrative is emphasized in the Swedish secondary level curriculum for technology education. This was not commented on as much by the US, UK or Irish judges. If this had been a summative task for Swedish students, the resulting ranks from the US, and UK and Irish judges could be misaligned with curricular intent. If this had been a formative task for Swedish students, the value that could be gained from feedback coming from less-informed assessors needs to be taken into account. Therefore, and as noted earlier, while the actual implementation of CJ in a classroom is a concern of relatively basic IT competency which could be achieved through training and an associated cost if a digital solution is desired, the successful implementation with respect to a valid summative output or relevant formative feedback will be very much dependent on the cohort of assessors.

20.5 Discussion

20.5.1 Implications for Practice

Research can never foresee what will happen in future practices; however, research may inform future educational practices to better meet learner's needs. While there is not a very extensive body of published research on CJ, the evidence that does exist suggests significant positive educational potential. CJ provides a highly reliable form of assessment with formative opportunity. Beyond its immediate use in the classroom, there is potential to adopt CJ in continuing professional development (CPD) contexts. As demonstrated by Hartell and Skogh (2015), CJ can be used by cohorts of teachers as a mechanism to encourage discussion about what constitutes evidence of learning which would address the concerns raised by Pettersson (2009). In line with the validation studies of CJ conducted by Bartholomew et al. (2018b), Jones and Inglis (2015), Lesterhuis et al. (2018) and Coertjens et al. (2017), CJ could be used in CPD to discuss the validity of traditional rubrics, or it could be used in the design of rubrics for national assessment. There is also potential to establish local or national clusters of schools whereby student work is submitted, for example as part of a national assessment, and teachers from that cluster act as judges. At a national level this would permit teachers to assess students work reliably and equitably while at the same time maintaining anonymity through a shared consensus if such concerns existed.

In addition to the features of CJ discussed thus far, one more aspect which is particularly important for educational practice is the experience of the students and teachers who have engaged with it. In the study conducted by Hartell and Skogh (2015), teachers were interviewed about how they experienced assessing students' work through CJ. The teachers unanimously reported that they enjoyed the overall experience, especially the satisfaction of seeing the work of students other than their own. In his PhD thesis, Canty (2012) examined undergraduate students perceptions of using CJ over 3 years, finding a generally positive disposition toward CJ as it encouraged positive competition and the sharing of ideas. Finally, Seery et al. (2019) found a similar attitude from undergraduate students who saw positives in making pairwise comparisons as they could learn more from critically examining mistakes made by peers and as this caused self-reflection on limitations in their own work.

20.5.2 Future Research

As it is relatively new, CJ is still quite unknown in general. It is, however, gaining interest across the world and has been put forward as a possible means of assessing students' learning in the future. In October 2016, the Royal Society invited a group of experts in educational assessment to discuss the future of assessment in science education, especially experimental science in years 11–18 of education. A selected group of international experts made presentations, and then a group discussion was held with the international experts who were invited as delegates. These presentations and discussions were summarized in the report from the event (The Royal Society 2016), which suggested:

> Future research might look at how students should learn science and the skills this entails; the validity of teacher assessment (including the need to increase confidence in this by mapping and developing teacher assessment competences and the use of comparative judgment); and the integration of summative and formative assessment (p. 3).

The fact that they specifically named and demonstrated clear support for CJ does not come as a surprise to those of us who participated in the seminar. One of us (Hartell) was present at the meeting and can report that six of the seven groups of experts suggested that CJ was the future of assessment in experimental science education.

Importantly, CJ has utility in any area where the objects of assessment are responses to open-ended tasks. However, from a research perspective there are a number of unanswered questions which directly affect its education use. With respect to using CJ in a classroom, there is a need for further dedicated research into attitudes toward CJ from all involved stakeholders. Such research could reveal further important research questions, and positive dispositions toward CJ would be necessary for its broad uptake. Further, as CJ from a user perspective essentially has two elements, the pairwise comparisons and providing written commentary. As noted by Mortier et al. (2015) there has been insufficient research on whether argumentation through writing comments effects decision making in the comparison stage. This relates both to subject expert and student judges. While the act of providing feedback to peers can have positive benefits for students (McConlogue 2015; van Popta et al. 2017), in situations where they could be acting as judges it may affect the resulting rank. There may not be the same agenda for expert assessors, but if their function is to provide a valid rank the circumstances which should be in place to enable this merit inquiry. A greater understanding of this would be needed to guide the valid use of CJ. Beyond research on the use of CJ in a classroom, there are many educational research agendas which could be supported by CJ such as:

- Understanding the "why" behind the judges' choices for different tasks in different subject areas, which could aid in meaningful task design.
- Exploring CJ as a tool for building assessment literacy and self-efficacy in teachers and students.
- Using CJ as a method for investigating the formative effect of critically evaluating the work of peers based on the worked example effect (Sweller 2006).

Perhaps what is most important to discussions concerning the future use of CJ and associated research is clarifying, from the perspectives of stakeholders, current assessment needs and identifying if and how CJ could help. Without the input of those would be benefit from the use of CJ, its development as a method may not serve its potential and intended purposes.

20.6 Concluding Remarks

Perhaps the foremost value with CJ is its capacity to serve as a catalyst for discussion among stakeholders including teachers and students as well as curriculum designers and teacher educators. Similar to how wine connoisseurs taste and discuss wine in communities of practice, the potential of CJ to foster teachers' assessment literacy and self-efficacy is immense and yet to be fully explored. CJ is a useful tool to unpack teachers' assessment practices, to uncover epistemological values and constructs and to explicate criteria for success in a much deeper way. Above all, CJ has great potential as a way to invite learners into the mystery of learning.

With all that said, it can be easy and tempting for people to get prematurely excited about new approaches or technologies especially when arguments have empirical support. In the case of CJ, while it is certainly promising and there are evidence-based examples of some contexts in which it can be very useful (design tasks, essays, and problem-based mathematics), there is a need for further research to establish a clearer remit for its potential use, taking subject area, school level, and learner expertise into account. While it could be used in the assessment of any open-ended task, before widespread adoption it needs to be questioned what context-specific added value is gained from using CJ over traditional assessment so as to make informed decisions around implementation. Further, even though there are multiple applications for CJ, appropriate use should always be kept in mind and this extends from task design to assessment. Learning outcomes must be designed and depending on these, teachers must choose appropriate tasks and exemplars both to ensure a meaningful learning experience and a useful assessment. For example, reflecting back on the sunflowers in Fig. 20.2, an understanding of whether the task related to abstract art or if the task was to produce a still life painting is necessary in order to make judgments on capability and to provide appropriate feedback. It needs to be considered what type of evidence students should collect and present for assessment and who should act as judges or assessors. There are also ethical issues to be taken into account, for example, who owns the copyright to the students' work, does the CJ software provider work in a General Data Protection Regulation (GDPR) safe environment, as a teacher is there support needed to help interpret the data, and what is the data going to be used for. Even if the use of digital CJ is not possible in classrooms, it is hoped that teachers and CPD organizers will make use of pairwise comparisons as a pedagogical strategy to facilitate critical discussion which can support equity for students, and that this chapter provides a source of inspiration for further innovations linked to the use of CJ in education.

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Chapter 21
T-REX (Teachers' Research Exchange): Infrastructuring *Teacher Researcher* Collaboration Through an Open Educational Ecosystem

Tony Hall, Marie Ryan, Jennifer McMahon, Marek McGann, Alison Egan, and Cornelia Connolly

21.1 Introduction

Supporting teachers to engage in research is considered a key priority in mobilising and enacting informed and sustainable change and reform in education. In 1996, Hargreaves noted how the gap between researchers and teachers constituted the "fatal flaw in educational research" (p. 3). Nearly twenty-five years on, much work remains to be done to connect teachers meaningfully with research, so they can constructively, habitually use research to support positive change in their classrooms and schools, and therewith enhance the learning experience of their pupils. Beyond this, considerable innovation and change are needed to encourage teachers to collaborate in, undertake and share their research. Equally, the professional educational research community needs to explore new ways of connecting accessibly and inclusively with teachers, so they are meaningfully involved in research, its usage, production and sharing.

In 2007, Broekkamp and Van Hout-Wolters highlighted the continuing disjuncture between the domains of research and teaching, which is exacerbated by the divergent agendas and concerns of schools and higher education, research-oriented institutions. Reflecting on the research-teaching gap, Snoek et al. noted in 2017: "The school and university can be considered as different worlds that have different expectations, an own culture and a unique discourse using different languages" (p. 363).

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What seem in particular to be lacking in terms of supporting teachers in research are guidance and resources on how to engage with research, and furthermore how to do research. Cornelissen et al. (2015) have written about the dearth of research support structures for educators and teachers, post-graduation, and to address this lacuna, they note the imperative for a school–university network.

Wegerif (2017) implies very well the essentiality of such a network, in highlighting the importance of theory in education. While often conceptualised as contradistinct and competing, practice and theory have complementary strengths and are mutually important if we are to improve educational structures and systems, particularly those that are deeply-engrained; as Wegerif notes: "Without theory we only have what is obvious, or 'common sense' or 'what everybody does'. But the aim of education is not always so obvious. A good theory can not only help us to see old things in new ways it can also help us to see new things that could not otherwise be seen".

Theory and research can potentially help us to reposition our education systems, away from problematic constraints that continually and problematically overemphasise summative and terminal examinations. This is especially salient when we consider the importance of more inclusive and participatory educational practices and teaching, imperative if key societal challenges are to be addressed: "I hope that theory can help guide education away from enslavement to what seems obvious in the immediate situation, like the need to do well on existing exams, and towards what is most important in the longer term, like the preconditions for effective global dialogue".

Research and theory can play a transformative role in education, which creates the imperative to close the research–teaching gap, and achieve synergies between practice and research in classrooms and schools. Consequently, the OECD (2009) has called for the "creation of 'knowledge-rich', evidence-based education systems" (p. 26).

Open educational resources (OERs) are now well established as digital supports that teachers, other educators and learners can utilise in schools and in informal settings. Alongside key developments in open resources for teaching, a seminal debate in the last decade has been the "opening up" of research to wider audiences and communities. The purpose of this has been to expand and enhance the impact of research, a central concern of funders and policy-makers, particularly where public money is being used to sponsor research. It is a contested issue. There are big questions currently being negotiated at government and national levels about who owns research, particularly publicly funded research that is sponsored by taxpayers, and therefore who is entitled to publish/share it, and how they should do so.

The Open Science movement advocates that publicly funded research should be freely available to all citizens, for the betterment of society. In Shakespeare's time (sixteenth Century), copyright as it existed then, usually meant that the publisher owned the work (and not the creator). The debate about who is entitled to publish/share research (and how) continues to the present moment. Since the 1990s, the Internet has played a significant role in changing the whole idea of research sharing, making research available to a much wider, global audience. However, there exist tensions around publication, with 2020 set to be a landmark year, particularly for Ireland, as the Open Access 2020 (OA2020 2020) global initiative implements a new open access publishing model that aims to enable unrestricted sharing, use and re-use of research outputs/publications.

As outlined by the OA2020, "Even though Open Access is now a shared vision of the world's academic communities, research councils, and funding bodies, nearly 85% of the world's scholarly outputs are still locked behind paywalls, inhibiting the full impact of research and putting enormous strain on institutional budgets".

With the evolution of Internet technologies, open access (OA) has emerged as a powerful new paradigm for research dissemination and publication. For example, a leading quartile 1 journal in the field of educational technology is the Open Access, *Australasian Journal of Educational Technology*; and universities now have open access publication repositories, which enable researchers to share widely their important findings for free, for example, ARAN (Access to Research At NUI Galway): http://aran.library.nuigalway.ie. These self-archiving platforms potentially help to promote and disseminate research more widely than would have previously occurred behind proprietary, pay-wall systems. This self-archiving is often called "Green Standard Open Access".

Concurrently, we have seen the emergence of a range of alternative ways of measuring research reach and impact, for example, altmetrics, as well as attendant problems of new systems of valorising research (Holland et al. 2016). It is indeed a complex landscape for research today, even for the professoriate, with so many competing and complex measurements, including bibliometrics and other algorithmic approaches.However, as Hammersley (1993) argued, the fact remains that if the goal of the teacher researcher is to be realised, then it can only help to strengthen the status and profile of teaching as a profession. In the Irish context currently, the increasingly complex and diverse professional demands that are being placed on teachers necessitate engagement with a range of supports, including research. Irish classrooms are today increasingly diverse and in recent years have witnessed significant reform in junior school curriculum at the post-primary level, the Junior Cycle. This is requiring of teachers greater decision-making in relation to syllabus development and assessment. A key feature of the wholesale changes to curriculum has been the introduction of classroom-based assessments (CBAs), where teachers must collaboratively design and assess innovative modules of pupils' work. This emphasises a whole new set of pedagogical research skills for Irish educators. Furthermore, the licence requirements for teaching are developing in Ireland, including formal professional development, which foregrounds reflective practice and research.

Purposefully designed research supports and structures are thus needed to support teachers as researchers; and in the Irish context, there are a number of initiatives emerging now at a national and system level, to close the gap and promote openness to research in schools and classrooms.

One of these key initiatives in Ireland is T-REX, Teachers' Research Exchange, a set of blended supports – including a multi-featured website – to promote and support teachers to collaborate in research, and utilise research in their classroom practice.

Introduced in 2015–2016, and originally called REX (The Research Expertise Exchange), T-REX has since scaled from a niche innovation project to a nationally funded initiative, and forms an integral part of a wider open educational ecosystem to support teachers as researchers (i.e. teacher researchers) in Ireland.

A key focus of T-REX is to act as a bridge between the so-called "small r" research taking place in individual classrooms, and "big r" research that is undertaken in formal, funded contexts, for example, third-level colleges and universities. These connections between different genres of research – at different scales and with different scopes – are crucially important, in order to raise the level of coordination and thus impact of research across the educational system. T-REX forms part of the emerging ecosystem in Ireland, enabling the possibility for an open online space for all educators and researchers to engage in productive discussions about key educational research questions, and beyond that, collaborate on projects that coalesce around key issues and topics of shared concern and interest.

This chapter highlights the touchstone moments and decisions in the development of T-REX since 2016. We outline the progress made in the project, particularly in terms of the design of key features and supports for teachers as researchers, and T-REX's important role as part of a wider open ecosystem for research in schools in Ireland. We conclude by pointing to the importance of *infrastructuring* to ensure that T-REX and its cognate and related innovations can be sustained as an open technology support for teachers, so that they can engage meaningfully and sustainably in research in Ireland.

21.2 The Teacher Researcher

Before describing the T-REX technology and tools, it is useful first to conceptualise the teacher researcher, as the basis of the rationale for systems like T-REX. As we shall suggest, the teacher researcher seems fundamentally a dual role comprising both research application and research generation.

It is recognised in the educational research and policy literatures that teacher education, from initial teacher education (ITE), through induction and early, career and on into continuing professional development (CPD, or PD as it is called in some jurisdictions), is integral to the improvement of educational outcomes and systems, in Ireland and internationally. The lifelong learning of teachers is paramount in helping to promote and advance better quality educational opportunities and outcomes for learners across the globe.

Indeed, when we speak or write today about teacher education, we more frequently refer to it as characterised by a continuum, acknowledging the potential change and diversity in learning experiences at different points in a teaching career.

In the Irish context, the regulatory/statutory body for teaching in the country, The Teaching Council (2020), identifies the three i's of the teacher education continuum: *initial*, *induction* and *in-service*. This highlights three key stages of a teaching career: (1) pre-service teacher education (conducted in a university context in

Ireland (Sahlberg 2019); (2) the new *Droichead* (Irish for "Bridge") framework to support newly qualified teachers' (NQTs') entry to the teaching profession and early career development; and (3) *Cosán* (Irish for "Path"), the proposed new framework for teachers' continuing professional development (CPD/PD).

Furthermore, research is accorded an increasingly important role in teachers' lifelong learning, and this applies in the Irish context too. Lofthouse (2016) has noted how teaching needs to be research-informed and research-led if it is to be viewed seriously, as a profession at all. The concept of the teacher as researcher encompasses both their ability to access and draw on research, and their capacity to undertake research, with a view to improving their practice as educational professionals in the twenty-first century. Hammersley (1993) rightly contends that teachers need to move from mere consumption of research, to being actively involved in its production. Critically, this entails transposing research to their classrooms and schools and their disposition to research collaboration, with other teachers and educational research professionals, including sponsored research projects and research centres and institutes. However, as Procter (2015) noted, the prospect of creating a research-based teaching profession has heretofore remained elusive, if not problematic. In recent commentary, Wiliam (2019) has shed light on why the notion of teaching as a research-based professional is so challenging. Indeed, it may well prove in the end to be an impossible endeavour. Wiliam insightfully examines the potential role of research in teaching, stating that the challenges faced by teachers are just far too complicated for research to be practically helpful in the classroom: "In my view, teaching appears to be less 'professional' than other professions because the problems that teachers need to solve are just much harder. Physics works because protons and electrons don't have good days and bad days; they behave consistently, and predictably. As soon as humans are part of the picture, things get a lot more complicated". The analogy with physics is well made and Wiliam's insightful analysis draws attention to the intrinsic complexity of classrooms. But is it an intractable complexity, beyond the reach and understanding of research? Whether or not, certainly it highlights how for teachers, if they are ever to become teacher researchers, they need meaningful supports. Furthermore, exemplars of excellent teacher researcher practice are warranted; as Black and Wiliam previously observed, teachers need "a variety of living examples of implementation, as practiced by teachers with whom they can identify" (1998, pp. 15–16).

Opening up access to educational and teaching resources, including research, represent important aspects of educational systems that seek to promote research – its use and undertaking – amongst their teaching professionals.

But how can this openness be implemented effectively, with and for teachers, who traditionally may not have engaged all that frequently – if ever – with research? Will making research open naturally lead to research-engaged teachers at scale? What kinds of interventions and initiatives might be required to help attract teachers to research, and beyond that: entice and support them to engage in impactful collaborative research?

Emerging from the original REX platform, the T-REX national website, online resources and tools aim to contribute to promoting the engagement of Irish teachers, both with, and in, research. This chapter will presently outline the history and development of T-REX, and the key components of the overall system, which are aimed at bringing teachers meaningfully into the national research conversation, so that they may benefit from, and moreover contribute to this open education research platform.

21.3 Open Research in Education: "Opening up" Schools to Innovation

> Where is the wisdom we have lost in knowledge; Where is the knowledge we have lost in information [2].[1]

Ostensibly, the advent of the Internet and related global WWW technologies, particularly in the late 1990s, has in many respects flattened and democratised access to information and knowledge.

However, as T.S. Eliot's quote prefigured, this increase in the availability and openness of information have seemed to underscore even further the importance of critical discernment in respect of data and information to be found online, and therewith the role of teachers in modern educational systems. As they always have done, teachers play a pivotal role in young people's and learners' education, particularly in mediating curricula and syllabi, in ways that enliven that content and encourage learners to reflect critically on it.

There exist now a number of creative initiatives aimed at helping schools to open up to innovation, including the use of research to enhance teaching practice. Internationally, developments such as MIT OpenCourseWare (OCW): https://ocw.mit.edu/index.htm stand as exemplars of how philanthropic efforts can create openly accessible, powerful digital resources for learning.

In the Irish context, the Internet has similarly exerted a considerable impact on education. A key open online resource for Irish teachers is Scoilnet: https://www.scoilnet.ie, a website designed to support primary and post-primary education environments; what is especially notable about Scoilnet website is that it is like an OCW, but specifically for the Irish educational context. It contains extensive digital resources for teaching, and importantly, presented in a bespoke fashion for the Irish educational system and curriculum.

Other notable initiatives include the project, *The Open Schools Journal for Open Science*. It is the first European peer-reviewed scientific journal, which accepts original papers written by school-aged students in Europe. Students and their teachers undertake research projects in the STEM areas, and then they can freely publish their data in the journal: https://ejournals.epublishing.ekt.gr/index.php/openschoolsjournal/index.

[1] Eliot (1934).

A further, critical development for Europe in building capacity for educational innovation and technology is *Open Schools for Open Societies (OSOS), 2018–2020*: https://www.openschools.eu/. OSOS is of paramount importance in helping schools in Europe to transform in such a way that they are open and responsive to innovation. This includes establishing partnerships with other schools and informal learning settings. Innovation is likely to fail if schools proceed with implementing change on their own (EU 2018), in *splendid isolation*. As Robinson (2010) has consistently noted, existing school structures and educational systems are difficult to change, characterised as they are by innate conservatism. Support tools and systems are needed to help schools and teachers to envision, initiate and propagate change in education. The EU's Open Schools for Open Societies (OSOS) model and tools will potentially help European educational leaders and teachers to evolve their structures towards open, localised and socially responsive learning environments.

There exist already several high-potential blended and virtual systems for open, online educational research, including MESHGUIDES: https://www.meshguides.org, the OSOS Portal (Open Schools for Open Societies): https://www.openschools.eu and T-REX (http://t-rex.ie). These platforms harness the power of digital technology to provide interactive community and usable "byte size" content for teachers, so they can more easily access and benefit from research collaboration and innovation.

We are now entering a new, potentially exciting and transformative period for teacher researcher innovation in Europe. T-REX is a partner in the recently successful EU research proposal, *BRIST: Building a Research Infrastructure for School Teachers*, which will look to coordinate teacher researcher supports and technologies across the continent, Ireland and the UK: https://www.nuigalway.ie/about-us/news-and-events/news-archive/2019/december/european-grant-to-help-develop-global-citizens-awarded-to-nui-galway-researchers-1.html. This will hopefully augment the infrastructuring that is already happening in respective national jurisdictions, and bring the benefits of a teacher researcher community network to a European level.

21.4 The Emergence of Infrastructuring in Educational Design Research

In the next section, we will discuss the signature features of the T-REX design, but it is important first to outline briefly a fundamental aspect of the conceptual design that informs the T-REX technology and tools. Although originally an exploratory, standalone innovation, T-REX is now part of a wider strategic context emerging in Ireland, to promote research more systemically amongst the teaching community. As mentioned previously, in Ireland, new formal requirements are developing around teacher's continuing professional development (CPD), including the role of research and lifelong learning.

Coined by Penuel (2015, 2019), *infrastructuring* is a concept and term he employs in the context of his field of design-based implementation research (DBIR). Infrastructuring is used to describe multilevel initiatives that endeavour to support truly scalable and transformational innovation in education.

In infrastructuring, key stakeholders are involved in a collaborative and participatory design process. Therefore, co-design – with and for learners and teachers – is an essential priority. Furthermore, for change and innovation to be lasting and impactful, they must be coordinated and sustained at multiple levels, and these levels are complex, encompassing key aspects, such as curriculum, technology, teacher CPD, policy formulation and enactment, even the physical design of the learning environs/buildings. Too often perhaps, important educational changes do not last because they happen in pockets of innovation, and the necessary infrastructuring, that is, coordination with other required changes and initiatives, does not happen. Issues of scale – extending beyond niche or *boutique* innovations – are integral to efforts to effect and sustain lasting, transformative educational change (McKenney 2018).

Effective infrastructuring also necessarily entails equity – it is imperative that the educational partners (teachers, pupils, policy-makers, CPD providers, etc.) are inclusively involved as co-designers in the change process:

> Rather, infrastructuring efforts demand that we also re-design educational infrastructures that influence implementation to be more equitable (Penuel 2015). When we "design across levels" in this way, we are engaged in a special kind of design research my colleagues and I call Design-Based Implementation Research (DBIR; Fishman, Penuel, Allen, Cheng, and Sabelli 2013), so named because we are concerned with developing knowledge, tools, and practices related to equitable implementation of innovations and the capacity of partnerships to improve outcomes through inclusive research and development processes.
>
> Penuel (2019, p. 10)

In terms of the wider context now emerging for teacher research in Ireland, there are a number of salient developments taking place to promote research and to position it potentially as a core aspect of what teachers do.

While not possible to reprise all aspects and reasons for the development of a teacher researcher community in Ireland, (within the constraints of this chapter), we instead provide key highlights.

Firstly, T-REX emerged in its current form through research into what teachers felt about research. When asked about REX and the original idea of a digital bridge to connect teachers with the wider researcher community, the following two exemplar quotes from in-service teachers illustrate the prevailing view held by teachers:

> If the aim of this is to try and create links between researchers and teachers I think it's definitely needed and I think it would be brilliant...

> They're two different worlds and there's a lack of a link between the two and it's a link that's needed, em [sic], to change practice, to move things forward

Key policy changes have also helped significantly to mobilise the current infrastructuring at a national level around the teacher researcher community. A crucial system development, concurrent with T-REX, has been the establishment and growth of CROÍ (the Irish word for "heart"): https://www.teachingcouncil.ie/en/Research-CROI-/.

Developed and promoted by Ireland's statutory body for the teaching profession, The Teaching Council, CROÍ comprises a suite of initiatives, (which now includes T-REX), aimed at supporting teachers to engage with, undertake and share research with each other.

CROÍ, as its name suggests, aims to put research at the heart of teaching and learning in Irish classrooms and schools. One of the several noteworthy aspects of CROÍ is the John Coolahan Research Support Framework (RSF), (named after the late Professor John Coolahan, one of Ireland's leading educationalists). Through the RSF fund, teachers can collaboratively apply for monetary sponsorship to undertake or publish research; proposals for funding are submitted by teachers in collaboration with other teachers and educators and researchers in higher education institutions (HEIs). The most recent call for the RSF particularly welcomed proposals to address key contemporary educational priorities, such as well-being and digital technologies. The Teaching Council also regularly publishes research ezines and hosts webinars on key research topics in education, in which teachers can virtually participate, engaging and asking questions through related social media. At time of writing, a recent research webinar and ezine was on the topic, *Digital Technology in Our Schools: Learning from Research and Practice*. Teachers can also access research journals and monographs through the Online Library feature of CROÍ, as part of the Teaching Council website.

In the Irish context, following two national reviews of teacher education (2012 and 2019), by Professor Pasi Sahlberg, the teacher researcher is now a core constituent part of the preparation and education of Ireland's future teaching community. Ireland's consecutive/graduate teacher education degrees have all been reconceptualised and redesigned as Level 9 (European Qualifications Framework) professional master programmes; and pre-service teachers must now undertake a significant research project, usually within the final year of their qualification. This has led to a substantial increase in the amount of classroom and school-based research in the country, reflected by the increasing volume of research submitted for review to journals such as *Irish Educational Studies*.

Thus, in summary, there is both a professional and policy appetite to seed research at the very heart of classroom practice and school life. Indeed, some schools have their own research/innovation teams, which they electively developed, to try to bring research and novel educational ideas more to bear for the benefit of pupils and learners. Consequently, developments such as CROÍ and T-REX are especially timely.

21.5 A Digital Bridge, Connecting Communities: Signature Features of the T-REX Design

The fundamental design of T-REX is a teacher researcher platform to connect three main constituencies of educational partners in Ireland: pre-service teachers; higher education professionals/educational researchers; and in-service teachers/practitioners.

Perhaps a useful colloquial way to describe/introduce T-REX is that it is like a "Facebook of educational research in Ireland". Users can register for the system and develop a profile, including a pen picture, research interests, sector and biographical details. They can then connect with other users around cognate and shared research foci and interests. The idea is a living and lively conversation around educational research that is mediated by the technology. As well as the online platform, T-REX users can download an app, which affords them access to key features and resources. The user landing page for the site includes a number of dynamic features, including recent community activity; upcoming events; and a live, updated feed of relevant news items about education, in Ireland and internationally (Fig. 21.1).

Users can also create and join different projects and special interest groups (SIGs), which are emerging and coalescing around important educational research themes, initiatives, trends and projects.

As well as a social networking-style interface to support connection and collaboration with other educators and researchers, T-REX also offers teachers a number of bespoke supports for engaging with, and in, research. The ideas for these innovations have emerged through the T-REX leadership and design team's extensive consultation along a number of contexts: systematic literature review; user-centred

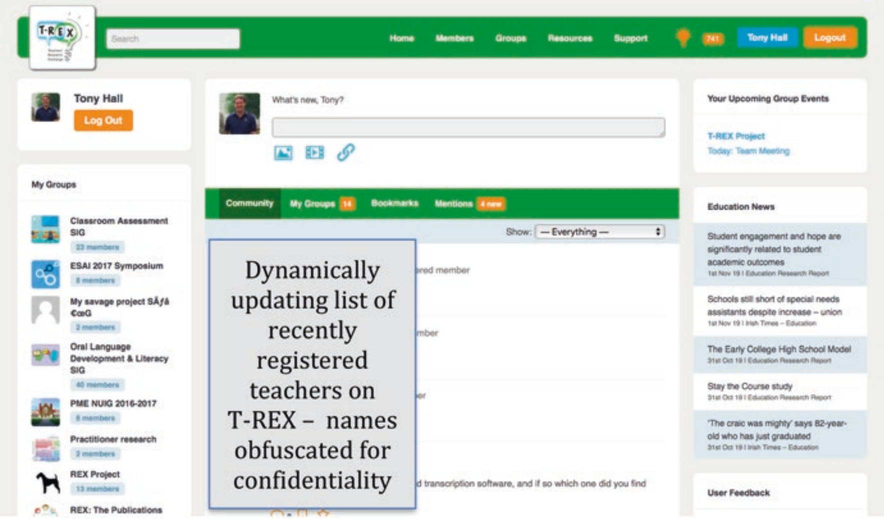

Fig. 21.1 The T-REX user interface

design, (e.g. Thinking Aloud Protocol to test features with users); review of similar extant technologies; and, crucially, engagement with key educational stakeholders and partners. We now outline highlights of these bespoke design features of the T-REX platform.

21.6 T-REX Talks

T-REX Talks is a series of expert academic research inputs, designed to engage teachers with recognised leaders in various fields of educational research internationally. Leading, frontier international experts in key topical areas of research are invited to provide an online chat (T-REXpert Chat) where teachers can join the discussion, ask questions and develop their understanding of key concepts and principles in hot topics in international educational research. An example was March 2019; Professor Susan McKenney, University of Twente, The Netherlands engaged teachers on the T-REX platform in a discussion of educational design research (EDR), a high-potential research methodology that has been emerging and growing in popularity in recent years, and particularly given the continuing interest in technological innovation in education over the last 25 years. An EDR SIG was formed on T-REX, which enabled teachers, educational researchers and the expert to share papers and ideas, and engage in focused discussion on key issues and the possibilities of EDR in classrooms and schools today (Fig. 21.2).

21.7 T-REX Module Innovation Framework (MIF)

As well as reaching teachers in-service, a key aspect of T-REX is to engage teachers pre-service. The T-REX Module Innovation Framework (now in its second round of funding) is a competitive scheme where module leaders and innovators in teacher education in third-level colleges and universities can apply for a €3000 grant to embed T-REX – its philosophy and technology – within their teacher education modules and programmes. As well as the seed funding, successful applicants receive curricula, pedagogical and technological support to extend T-REX systemically in their modules. At time of writing, the first round of MIF awards has just been announced: https://www.mic.ul.ie/news/2019/mic-lecturer-wins-teaching-innovation-award. The MIF is a critical aspect of the system as it helps directly to mobilise the initial teacher education research community to engage with T-REX. Teacher CPD is a continuum and engaging with pre-service teachers constitutes a core aspect of promoting research-engagement when they form their initial teacher identities, prior to embarking on their professional teaching career as lifelong learners, and hopefully also as lifelong researchers.

Fig. 21.2 T-REX talks: Educational design research with Professor Susan McKenney (March 2019)

21.8 T-REX Bytes

Providing teachers and educational professionals with research digests has emerged as a key activity in terms of promotion of research in schools. For example, developed by the Education Futures Collaboration (EFC) in the UK, MESHGuides (**M**apping **E**ducational **S**pecialist Know-**H**ow) https://www.meshguides.org provide teachers summaries of research on key issues, themes and topics for the classroom. A further, highly original and compelling innovation for research-sharing with teachers is Cambridge Mathematics' development of *Espresso*s, condensed, attractive and accessible guides for maths teachers to apply latest research in their classrooms: https://www.cambridgemaths.org/espresso/. Recently introduced, T-REX Bytes serves a similar function and provides teachers with a visually appealing and easy-to-read and navigate précis of a research project, research data or methodology.

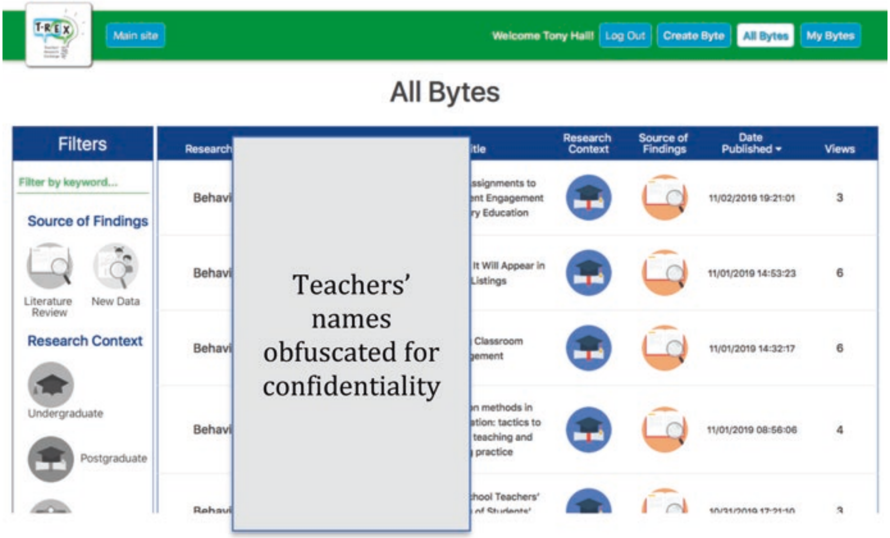

Fig. 21.3 T-REX bytes research summaries – created by and for teachers

Teachers, educators and researchers can create and upload their own T-REX Bytes, using the easy-to-complete, online pro-forma for generating a summary of research. They can also enhance their T-REX Bytes with multimedia, images and video, where this is available (Fig. 21.3).

Further developments currently for T-REX include T-REX Bitesize Courses and the T-REX Research Directory. The Bitesize courses focus on developing teachers' confidence and competency to engage with and undertake research. The first two courses are primers and address identified, key priorities for teachers and other educational researchers, many of them embarking on research for the first time. The first course looks at "Getting into research"; and the second, on the interlinked, related topic of "Completing a critical literature search and review" (Fig. 21.4).

Modelled on the European Union's repository, CORDIS: https://cordis.europa.eu, the T-REX Research Directory (RD) will contain hyperlinked details of active and archive research projects. T-REX users will also be able to add their projects to the RD. It will thus serve as a first national database of research projects in Ireland.

21.9 Discussion and Concluding Insights

Open educational resources (OERs) are well established, and critically important in supporting learning and teaching in the twenty-first century. Repositories such as MERLOT in the US and MESHGuides in the UK exemplify how open online learning and research resources have gained prominence as key contributors to the advancement of teacher education across the three i's of the teacher professional

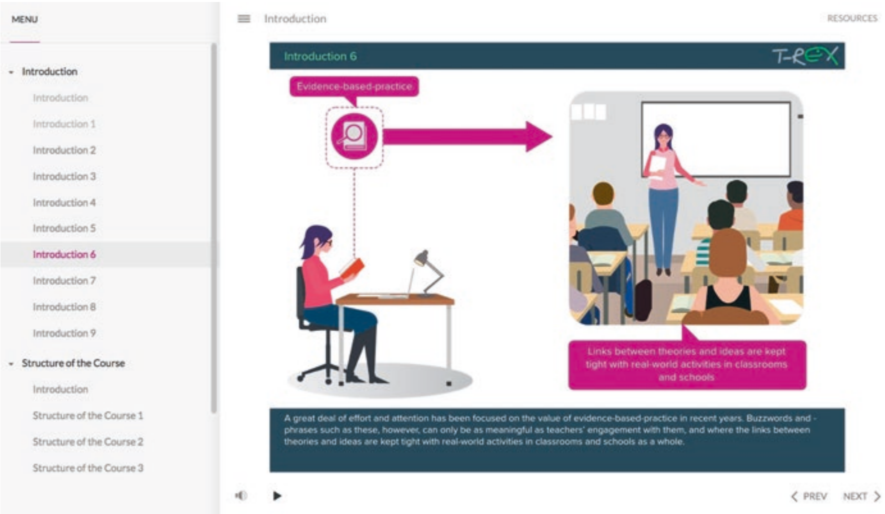

Fig. 21.4 T-REX short course: "Getting into research"

development continuum: initial, induction and in-service. Research is identified as a key enabler and driver of innovation and openness in education. OECD (2009) has called for education and teaching to become more *evidence-based*, and consequently informed and enhanced by research.

In 1965, the *Investment in Education* report, commissioned and sponsored by the OECD, provided the Irish Government *consequential evidence* (Barab and Squire, 2004) of the pressing need for a proper secondary education system in the country. The data and findings of this historic research report contributed significantly to the free second-level scheme (introduced in September 1967), which transformed forever educational opportunity in Ireland, and illustrated how research can have a truly transformational impact on education and teaching.

While not making any such high-claims for T-REX, it is supporting teachers to access and share the latest insights from cutting-edge research at times and in places that suit them. Support tools and systems are needed to help schools and teachers to envision, initiate and sustain impactful change in education. Whether teachers are looking for a summary of the latest research on a topic of interest to their classroom, or they want to discuss and share their research with fellow teachers and researchers, or all of the above – T-REX provides them a free, open platform to do this. T-REX enables conversations, collaborations and potentially stronger connections between research, policy, and practice, and between schools and HEIs.

In this chapter, we have outlined the first five years of the development of the T-REX platform, and how we have endeavoured to deploy an open educational research ecosystem to infrastructure teachers' participatory engagement with other teachers, educational professionals and cognate research communities. Future plans for development will be predicated on our ongoing engagement with teachers, and evaluation data we receive from them. This is augmented by the governance of T-REX and continual dialogue, consultation and partnership with our funders and key educational stakeholders, including The Teaching Council, National Council for Curriculum and Assessment, Centre for Effective Services and National Forum for the Enhancement of Teaching and Learning in Higher Education.

While we have made significant progress with T-REX, in the broader context of national, system-level developments and supports for the teacher researcher in Ireland, significant challenges remain, including growing the number of active users of the system, particularly those who will utilise the resources available to collaborate in, and share their research.

If T-REX ultimately proves successful, it will almost certainly be as a result of the impact of the technology, in conjunction with the necessary infrastructuring beyond the system itself. We may be reaching a tipping point for the notion of the teacher researcher in Ireland – there exists now the motivation at system level to support research in schools – and T-REX constitutes an important part of the nascent infrastructure to accomplish this.

One can argue that teachers are inveterate researchers; they are always making informed decisions on how best to teach, drawing on different resources, insights and expertise. It is hoped that this invaluable informal research that teachers do every day will become systematised and shared through a national collaborative framework that values this work, mediated by the open educational research platform of T-REX.We do not argue that all the parts of the puzzle are in place nor do we contend that T-REX is a silver bullet to address the educational research gap in Ireland.

However, it seems, the time is ripe now – especially given the supportive national framework that is emerging through CROÍ – to promote and support research amongst the teaching profession in Ireland. Through its suite of bespoke technology and tools, T-REX is well positioned to contribute significantly to infrastructuring this emerging teacher researcher network; it stands as a digital bridge connecting Ireland's diverse research and teaching communities.

Acknowledgements The authors acknowledge our educational partners, without whom T-REX would simply not be possible. Firstly, our funders: The Teaching Council, National Council for Curriculum and Assessment (NCCA), Centre for Effective Services (CES), and The National Forum for the Enhancement of Teaching and Learning in Higher Education, for their continued and renewed support, commitment and contributions to making T-REX thus far successful. We also thank our advisory panel for their continued and considerable support and guidance. Finally, and of course not least, we thank the many teachers, educators and researchers throughout Ireland – across all educational regions and sectors – whose continued use of T-REX for research and collaboration helps to ensure the project moves forward as an open ecosystem for the burgeoning teacher researcher community in Ireland. We also thank our respective institutions: Mary Immaculate College, Limerick (T-REX Coordinator), University of Limerick, NUI Galway and Marino Institute of Education, Dublin, for their continued support of T-REX.

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Chapter 22
The Role of Remote Observation in the Professional Learning of Student Teachers and Novice Placement Tutors

Brendan Mac Mahon, Seán Ó Grádaigh, Sinéad Ní Ghuidhir, Breandán Mac Gearailt, and Emer Davitt

22.1 Introduction

In the field of initial teacher education (ITE), developments in remote live-streaming technology are currently reshaping conventional methods of classroom observation and supporting the professional development of student teachers (Liang 2015; Wang and Wiesemes 2012). For ITE providers, this has obvious appeal. Lessons with student teachers can now be observed by teacher educators in real time through digital networks without the need to physically visit school sites. Cost benefits can be substantial, reducing travel, time and expense (Cooper 2015) while simultaneously increasing the frequency and flexibility of observations amid often onerous teaching and research responsibilities on ITE programmes (Goodson and Allen 2014; Krause et al. 2018). Remote observation has also been shown to reduce reactivity and the potential negative impact the physical presence of an observer can have on teacher confidence and classroom dynamics (Bolton 2010; Wash et al. 2014).

The approach brings challenges, however, from concerns in relation to child protection and General Data Protection Regulation (GDPR), to technological issues such as restricted internet access (Van Boxtel 2017). In addition, the limited perspective of the camera, particularly when a single fixed camera is used (Marsh and Mitchell 2014), may reduce the sense of control by narrowing the "gaze" of the observer (Dyke et al. 2008, p.38). While Krause et al. (2018, p.31) maintain that "traditional on-site observations will provide the supervisor with the most comprehensive observation experience", Dyke et al. (2008, p.45) conclude that the "judgements of online observers" are nevertheless "comparable to face-to-face observations". Heafner, Petty and Hartshorne (2011, p.154) furthermore suggest that both modes of observation are comparable in supporting the "professional growth" of student teachers.

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Viewing teacher professional development as “a process of identifying weaknesses and taking actions for improvement”, Liang (2015, p.236) argues that live remote classroom observation can moderate the level of subjective judgement by increasing the number of observers and variety of feedback sources. Effective feedback leads to the formulation of learning goals (Hattie and Timperley 2007), and is a central element in helping pre-service teachers transfer learning from ITE programmes to the classroom (Scheeler 2008). Without “frequent high-quality, performance-based feedback from university faculty, pre-service teachers’ abilities to reflect on their learning, growth, and development greatly diminishes, thwarting motivation and dedication to future improvement” (Dieker et al. 2014, p.46). Scheeler, Ruhl and McAfee (2004, p.205) further maintain that feedback that is “immediate, specific, positive, and corrective holds the most promise for bringing about lasting change in teacher behavior”.

While utilising innovative technology to enhance teacher preparation and development is a blossoming area of research (Van Boxtel 2017), less attention has been given to its role in supporting the professional learning of novice teacher educators (Regan et al. 2017). In particular, there has been “little research…on how novice university supervisors develop a practice of field-based teacher education” (Cuenca 2010). This is not surprising perhaps, given that “the work of the university supervisor has been largely ignored” (Steadman and Brown 2011, p.53), with the result that “research on supervisor professional development has been limited” (Burns and Badiali 2015, p.420). A study by Chilton and McCracken (2017) found that some practicum supervisors reported feeling less “hands on” with the process of remote observation. In contrast, however, synchronous transmission of lessons from school classrooms has been shown to facilitate opportunities for reflection and reflexive discussion among observers as they react to unfolding events in real time (Marsh and Mitchell 2014; Mitchell et al. 2010). This would suggest clear opportunities for professional learning among all observers, practicum supervisors included.

22.1.1 ITE in Ireland

In Ireland, recent reform of ITE has seen postgraduate consecutive programmes increase in duration from 1 to 2 years with student teachers now typically spending 30 weeks and a minimum of 100 hours on direct teaching in at least two school placement settings (Teaching Council 2013, 2017). While on placement, student teachers are observed, mentored and evaluated by Higher Education Institution (HEI) placement tutors, with “observation and feedback…in a timely fashion” regarded as “the two most valued elements of structured support” (Teaching Council 2013, p.15). Research in the Irish context furthermore shows that HEI feedback is “highly regarded” by student teachers (Hall et al. 2018, p.13).

Higher Education Institutes providing ITE are also now required to be “research-based” and teacher educators consequently expected to place a “strong focus on research as a basis of teaching and learning” (Sahlberg et al. 2012, p.24–25). In addition, the Digital Strategy for Schools 2015–2020 (Department of Education and Skills 2015) requires ICT to be embedded in the planning, design and delivery of all ITE programmes. Recent findings, however, reveal pressures and tensions experienced by both student teachers and HEI placement tutors in the context of the above developments. In their study of school placement on ITE programmes in Ireland, Hall et al. (2018, p.170) found that visits from the HEI placement tutor detracted from the overall school placement experience of some student teachers due to "nerves and anxiety…of a dramatic nature, linked to fear, surprise, unpredictability, feelings of panic, even terror". Furthermore, Gleeson, Sugrue and O'Flaherty (2017, p.27) found high levels of frustration at heavy teaching and administrative workloads in their examination of Irish teacher educators' capacity to be research active, with many finding the "dual demands of ITE deeply conflicting as they struggled to combine student teacher formation and research while securing the advancement of their own careers within academic institutions where research productivity is increasingly prioritized". The authors conclude that "teacher educators are increasingly faced with the choice of disavowing any involvement in ITE programmes" or "accepting major consequences for their career trajectories" (Gleeson et al. 2017, p.28).

22.2 Research Context and Questions

This study was undertaken with student teachers on a 2-year, postgraduate, initial teacher education programme for second-level teachers, provided through the medium of the Irish language in the National University of Ireland, Galway. iPad is deployed 1:1 with student teachers on the programme and mobile technology is embedded in all aspects of practice (Mac Mahon et al. 2016, 2018, 2019).

Student teachers on the programme complete school placement in Irish-medium schools nationwide, encompassing urban and remote rural areas throughout the country, as well as offshore islands. School placement is undertaken over three separate block periods in Year 1 and again in Year 2, with student teachers receiving a minimum of three visits in each year from placement tutors (at least one in each block). The geographic spread of schools poses particular resource-based challenges for the programme team who must simultaneously balance the demands of on-campus teaching and research with school placement visits for student cohorts across both years. At the time of conducting this research, a total of 24 student teachers were registered in Year 1 and 27 in Year 2 of the programme, while the teaching and school placement team consisted of three full-time lecturers, along with two novice placement tutors, new to their roles as teacher educators. Consequently, the aim of this research study was to examine the introduction of remote observation to the programme and investigate its impact on professional learning. The study focused on two central questions:

1. Can remote observation support the professional learning of student teachers and placement tutors?
2. What are the perceived challenges for student teachers and placement tutors with regard to using remote observation?

22.3 Materials and Methods

A qualitative case-study approach was adopted, to investigate a "bounded system" (Stake 1995, p.2) "within its real-life context" (Yin 1994, p.13), and semi-structured interviews were conducted with eight student teachers and both novice placement tutors. Student teacher participants were purposefully selected from schools representative of the wide geographical spread of teaching placement schools collaborating with the programme. Consequently, six female and two male student teachers from schools on the east coast, the midlands and remote Gaeltacht (Irish speaking) areas in the west and north west of Ireland were selected and agreed to participate. Teaching subjects included Irish, French, German, History, Geography, Economics, Mathematics and Chemistry. The student teacher sample was drawn exclusively from Year 1 of the programme, where assessment and progression in relation to the school placement element do not have the higher stakes grading system that is applied to its assessment in Year 2. Following Hall et al. (2018, p.98), it was stressed to participating student teachers that while placement tutors remained involved in their assessment, the use of remote observation was "primarily about enabling the ST [student teacher] gain confidence and competence as a professional".

The two participating novice placement tutors (one male and one female) had recently been seconded from their schools to the programme and were new to their roles in initial teacher education. Prior to joining the programme team, both were practising second-level teachers, having each separately accumulated approximately 20 years of teaching experience.

Before commencing their second school placement in January/February 2018, all participating student teachers were made familiar with Zoom, a distance conferencing application (Zoom Video Communications 2018), and downloaded the app onto their iPads. They were also supplied with flexible iPad tablet holders. All student teachers had previously received one on-site visit from placement tutors on the first block of school placement in October 2017, during which both novice placement tutors had accompanied their more experienced colleagues to receive mentoring on the process. Placement tutors were therefore familiar with school contexts, and permission was obtained from each school principal to conduct two subsequent remote live observations of class lessons in the following placement block. Consequently, a total of 16 lessons were observed remotely over a 2-week period in January/February 2018, with student teachers making lesson plans and relevant resources available in advance to placement tutors through an online e-portfolio system. For observed lessons, each student teacher placed the iPad in the flexible tablet holder, situated it in a suitable position in the classroom to allow for a wide visual field and then live-streamed themselves teaching a class lesson. Using a large computer screen with embedded camera and muted microphone, all lessons were remotely observed in the university by the two novice placement tutors in the company of at least one, and frequently all three, of their more experienced colleagues. These live, remotely observed lessons were not recorded.

Immediately following each class, however, one-way observation became live, interactive two-way conferencing through the Zoom app on the student teacher's iPad, during which each student teacher received detailed feedback about the lesson from all placement tutors. Feedback sessions typically lasted 40 minutes and were recorded. Copies of digitally recorded feedback, along with a written summary of emerging recommendations, were then promptly forwarded to the student teacher for reflection and implementation. Within 1 week, this cycle was repeated and student teachers were again remotely observed teaching a lesson to monitor progress and gauge if recommendations had been implemented. This was again followed by detailed recorded feedback from placement tutors.

At the conclusion of school placement, semi-structured interviews were conducted with all participants. Interviews lasting 30–40 minutes were conducted in Irish, recorded and transcribed verbatim. Transcripts were then translated into English and checked for accuracy against the original Irish medium recordings. An inductive approach was then used to code and establish emerging themes from the data (Strauss and Corbin 1990).

22.4 Findings and Discussion

Findings build on previous studies acknowledging live remote classroom observation as an effective tool for supporting teacher development (Liang 2015; Wang and Wiesemes 2012), and in addition, provide new evidence regarding its efficacy in supporting the professional learning of novice placement tutors.

For both placement tutors, the process of remotely observing classes together and in the company of more practised colleagues facilitated "experience and learning" in a range "of different contexts" (Placement tutor 2) and "was immediately worth it" (Placement tutor 1). All student teachers were equally positive with regard to their experience of remote observation with just one stating an exclusive preference for face-to-face visits:

> it's a personal thing I think between a teacher and a supervisor and I'd prefer to be able to physically sit in front of a person and talk to them (Student teacher 1).

However, there was consensus among all other seven student teachers and both novice placement tutors, that a combination of physical and remote visits would be their preferred approach in future. The importance of placement tutors physically visiting schools, for the first visit in particular, was highlighted as vital in enabling them "to see the school context" (Student teacher 8).

22.4.1 *More Natural*

All participating student teachers declared that the process of being observed remotely was "more natural" (Student teacher 1) and "more realistic" (Student teacher 8) for both themselves and their pupils. It was stated that pupils "were different in the class when the placement tutor was there physically" (Student teacher 5), and that while this might make it "easier to discipline" pupils, the result nevertheless was that classroom dynamics were affected and pupils became "too quiet" (Student teacher 6). In contrast, the use of technology-enhanced classroom observation allowed pupils to forget they were being observed and to "ignore the iPad" (Student teacher 2). As a result, pupils "were participating…were not looking around at a placement tutor" (Student teacher 1) and "it was more real as a class" (Student teacher 6). Similarly, it allowed student teachers themselves to forget that they were being observed:

> Not that the supervisor interrupted the class but it is better when there is an iPad set up at the back of the room, it doesn't upset the class and you forget it (Student teacher 2).

Consequently, student teachers "felt better" (Student teacher 5), were less "nervous" (Student teacher 4) and anxiety levels were reduced:

> I think it is better because I get very nervous when someone is looking at me and I start making mistakes and getting more nervous. But when the person is not physically there it is easier. One hundred percent…I don't think it is as bad when you are unable to see the people (Student teacher 3).

Both participating placement tutors similarly agreed that observing remotely reduced reactivity, whereas "when you go into the classroom they notice you like they would a teacher" (Placement tutor 1) and pupils "are not so active or talkative" (Placement tutor 2). This allowed placement tutors to view student teachers in a "more natural" context (Placement tutor 2), which supported and strengthened evaluation:

> Yes, it is so different…in this way you can see how the teacher is in front of the class (Placement tutor 2).

Wash et al. (2014, p.61) similarly note that remote observation allows student teachers "to teach to the students and not to the observer", which in turn, enables placement tutors to make judgements in more authentic settings, where the limitations of student teachers are "fully exposed to observers so the information gathered and subsequent comments made…are likely to be far more credible" (Liang 2015). Enhancing the credibility of feedback equally enhances its likely impact as it is "directly to do with the personal, context-laden 'here and now' experience" of the student teacher (Hall et al. 2018, p.107).

22.4.2 Immediacy and Range of Feedback

For student teachers in this study, one strength of using remote observation was that it facilitated, at the end of each lesson, "really helpful" (Student teacher 8) and "most effective" (Student teacher 6) feedback and "advice from more than one person" (Student teacher 3). In addition, they were able to "look back on that recording" (Student teacher 4), before reading "bullet points in an email so you could focus on the points" (Student teacher 8). While one student teacher stated a preference for receiving recorded feedback only, all others preferred a combination of both, as the extent of "so much feedback" (Student teacher 7) in the recorded post-lesson conversation made it difficult, for some, to formulate specific goals. However, the provision of written feedback also "clarifies that you must focus on a, b, & c…so I knew specifically what was required" (Student teacher 4) and facilitated implementation "in the next class" (Student teacher 8).

Preston and Younie (2016, p.5) argue that "Deep learning, which is replicable and sustainable over time, can be achieved through providing immediate and contextualised feedback that the teacher can instantly put into practice". Hall et al. (2018, p.107) likewise view this post-lesson exchange as a "professional conversation…and thus a powerful source for the shaping of competence and identity of the beginner teacher." Similarly in this study, both novice placement tutors also highlighted the importance of immediate feedback. In addition, having access to "another voice…[and] listening to other people giving feedback" meant that both novice placement tutors were "learning all the time" in the context of "a team of supervisors in comparison to sitting at the back of the classroom" (Placement tutor 1). As a result, all placement tutors could be "on the same page at the end about the recommendations we would make" and both novice tutors were later "more confident" (Placement tutor 2) when going out to schools on their own:

> We liked that there were more than two of us involved and that we could be conversing as the class was in progress and taking notes, something you could not normally do…and [names another placement tutor] saw things I did not see…so when it came to the conversation with the student teacher then we had really developed the feedback having already discussed it (Placement tutor 1).

Having other voices in the process also introduced an "important dynamic" (Placement tutor 1) when discussing feedback with the student teacher:

> When it is just one-on-one it can be one-versus-one, but when another person comes into the conversation it changes everything. That is very important in the context of feedback that you are not making a judgement on another person…and sometimes there were strong messages being given to some students, very strong, and when I said it and then someone else came in stronger…I did not water it down. Maybe it would not be as strong if I were on my own (Placement tutor 1)

Teacher educators have long been a neglected group (Cochran-Smith 2003), and this is even more pertinent in the context of novice placement tutors. In addressing such neglect, this research study provides strong evidence to show how remote observation facilitated the professional learning of the two participating novice placement tutors. Having access to a greater range of "authentic" teaching contexts, in a shorter period of time, and in the company of more experienced placement tutors, served as an "entry point for the development of personal reflective practice in a group learning environment where a community of practice shares and develops their understanding of teaching and learning processes" (Wang and Wiesemes 2012, p.357). Engaging in professional dialogue with more experienced peers enhanced both professional learning and confidence. The impact of social learning through dialogue furthermore highlights opportunities for all teacher educators involved in school placement to benefit from ongoing professional development through the use of remote observation.

22.4.3 Visit Frequency

For student teachers, having remotely observed placement visits that "were closer together…in comparison to the large amount of time between physical visits' (Student teacher 8) made it "easier to act much faster on feedback" (Student teacher 4) and to "implement the recommendations" (Student teacher 6). Cuenca (2010) reminds us that a "persistent theme in teacher education research suggests that the limited interactions between the university supervisor and the student teacher on periodic visits typically have little impact on the educational development of the student teacher". While acknowledging that more frequent visits might also place additional "pressure" on student teachers, this was, nevertheless, seen as "a good thing…with regards to teaching and development as a teacher" (Student teacher 3). The result was that "you would be really satisfied at the end to know that you had made progress" (Student teacher 5):

> There are real advantages to the technology because you [the placement tutors] are able to give that feedback and maybe the week after to go back and see are they implementing it. With the physical visit you don't see if the development is made until you are out again in the next block. So in that way I'd say it was more effective for the student, that they are learning and able to implement these points, and that the placement tutors are able to see that they are learning (Student teacher 1).

Likewise, for both novice placement tutors, "one of the great advantages [was] that we could go back to them within a week" (Placement tutor 2), as "To change practice you must do this (Placement tutor 1). When asked why she placed less value on the feedback obtained following traditional face-to-face visits from placement tutors, one student teacher replied, "Yes but the supervisors would not be coming out to the school the next day like a remote visit to monitor development" (Student teacher 5). This illustrates the point made by Dieker et al. (2014, p.50) that technology-enhanced supervision and feedback "allows teacher educators to provide pre-service teachers with more opportunities to effectively learn to teach," and as a result, "is no longer a luxury—it is a necessity".

22.4.4 Challenges

Both novice placement tutors highlighted the occasional poor quality of sound as being “the worst problem” (Placement tutor 1) encountered when remotely viewing lessons, with the result that “there were times we were saying ‘What are they doing now?’” (Placement tutor 2). However, both felt “positive that this could be rectified” (Placement tutor 2) by using microphones. Similar technical challenges evident in the wider research literature, such as sound quality or the limited perspective of a “fixed” camera, have indeed been addressed elsewhere through the use of microphones (Berkley and Conklin 2016) and Swivl technology (www.swivl.com) to track the movement of the teacher in the classroom (Chilton and McCracken 2017; Coogle et al. 2015).

Technical issues were highlighted also by student teachers who felt “pressure on you to organize everything, that wifi and the technological side of it is working” (Student teacher 7) or “getting the class to go to another place as there was no wifi in certain classrooms” (Student teacher 8). As a result, all student teachers emphasised the need to anticipate challenges and be “well organized in advance” (Student teacher 5) for the remote visit.

Perceptions at a wider school level with regard to remote observation included one student teacher reporting that teachers in the school “thought it unbelievable, that [placement tutors] were so lazy not coming to the school and saving money” (Student teacher 3). More pressing, however, is the apprehension expressed by one principal who feared that remote observation would reduce contact and thus weaken the relationship between the HEI and the school. At a time when “School-HEI partnerships are developing with high levels of communication and sharing of documentation from HEIs to schools” (Hall et al. 2018, p.15), fears must be allayed among school principals who wish to build on these partnerships. As well as an effective tool for the professional learning of student teachers and placement tutors, remote observation holds the potential to develop greater links and partnerships between teacher education institutions and schools. Live transmission from classrooms in partnership schools to the teacher education classroom could give access to a wide range of educational practices and afford opportunities for student teachers and placement tutors to engage in social learning and “to react to unfolding classroom events, which can stimulate reflexive discussion of a wide range of classroom practice” (Marsh and Mitchell 2014, p.412). As Placement tutor 1 commented, “if certain teachers in schools were willing to allow us to observe their classes then the technology would make this very easy”.

22.5 Conclusion

Preston and Younie (2016, p.5) note how remote observation is “an innovation that may be resisted if the introduction is not managed with sensitivity” and must be seen by student teachers not as a “means of surveillance” but rather one of “teacher control and empowerment". Facilitating access to authentic classroom contexts, as well as enabling professional dialogue, social learning and the provision of credible feedback for immediate implementation and review, all demonstrate how the application of remote, live technology can support the ongoing professional learning of student teachers and placement tutors. However, its potential for empowering all stakeholders involved in pre-service teacher education should be recognised also, through the opportunities it offers for the development of stronger links between schools and initial teacher education institutions. Rather than be resisted, it is for these reasons an innovation to be embraced.

Furthermore, remote observation also offers some relief from "a multiplicity of expectations and a paucity of time" (Gleeson et al. 2017, p.24) experienced by teacher educators struggling with contemporary HEI mandates which "frequently pressure teacher educators to choose between serving the professional community of teaching and advancing their academic careers by being more focused on securing research funding and increasing their publication output" (Gleeson et al. 2017, p.20). In doing so, it presents an opportunity to rebalance what is increasingly becoming a dwindling emphasis by institutes involved in initial teacher education on "the craft" of teacher education as distinct from the singular "pursuit of research" (Gleeson et al. 2017, p.20).

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Chapter 23
Exploring the Ripple Effect of 'Always On' Digital Work Culture in Secondary Education Settings

Caroline Murphy, Ann Marcus-Quinn, and Tríona Hourigan

23.1 Employment Context

The Department of Education and Skills has principal responsibility for the coordination of teachers' employment in the Irish education sector. Employment relations within the sector are regulated by legislation and collective agreements reached between this government department and trade unions (Murphy et al. 2019). Trade union membership is strong in the teaching occupation (O'Sullivan et al. 2020). While there have been some notable instances of industrial action, up to and including strike activity, for the most part, the industrial relations climate in the sector is quite stable. Teachers in public (non-fee-paying schools) make up the largest component of staff in the education sector and most share commonality with regard to pay and conditions such as holidays and leave entitlements. However, some terms and conditions of work are effectively developed at local level between teaching staff and the management (largely principal led) of the school they work in. Expectations and control over working time arrangements are one of many key decisions taken at the local level which can significantly impact teachers' work. As a profession, teaching is viewed as one which has many advantages from a work–life balance perspective. Indeed, traditionally, the public sector has been viewed as the vanguard of promoting positive working time arrangements. However, parts of the public sector, education being one, have increasingly come to be defined as market commodities (Grummell et al. 2009; Mercille and Murphy 2017). International research argues that the marketisation of education is resulting in the intensification of work, and contributing to greater performance management around teachers' work (Fredriksson 2009; Mercille and Murphy 2017). As such, the nature and context of work have altered and share more similarities with the private sector, in particular in relation to demands around working time, and the

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development of an ‘always on’ culture. The drivers for this can be viewed as partially rooted in the marketisation agenda, and also as symptomatic of broader societal changes brought about through enhanced technology (Mullan and Wajcman 2019), a trend which has accelerated with the onset of Covid 19. An important issue to note is that made by Hesselberth (2018:2007): ‘resistance to technology is not necessarily about technology in the narrow sense of the word (as specific techniques, devices, or practice), but rather more often pertains to a more general loss of ways of livelihood made unavailable to us through the logics of datafication and automation enabled and reinforced by mass-mediated forms of networked connectivity’. In the context of teaching, the use of technology within and outside the classroom has the potential to further alter the profession.

23.2 Work Extension and ‘Always On’ Culture

In many ways the advent of ICT at school level has mirrored the adoption of ICT in the wider economy and society. While the benefits of technology are espoused, from a labour perspective, it has been argued that the impact of ICT on work practices can lead to a form of work extension. Work extension is broadly defined by Mullan and Wajcman (2019:33) as the encroachment of work on individuals’ time off through ubiquitous connectivity. Being more specific, they define work extension as the process of undertaking ‘work that occurs beyond a fixed workplace (typically at home) at times outside of normal working hours (typically in the mornings before and/or evenings after the main period of work’. The notion of work extension can be measured in different ways, for example, in regard to the extent that it impacts workers’ sense of time pressure or their ability to make commitments to activities outside of work. Enhanced technological capabilities facilitate work to be carried out wherever workers happen to be at the time the work need arises (Messenger and Gschwind 2016). However, such working can be used to supplement or extend the working day, which can have a detrimental impact on work–life balance (Middleton 2008). The advent of the smartphone, Cole (2016) argues, increasingly allowed workers to routinely perform workplace duties in their own time, blurring the division between work and personal life. Mellner (2016) argues that while, on the one hand, such technology can have advantages in relation to time and control of work, it is also associated with increased expectations to be available outside working hours (Middleton and Cukier 2006), resulting in what is now colloquially known an ‘always on’ culture of working. Due to changes in technology and global connections, work intensity has increased over the last few decades (Green 2001, 2004; Valeyre 2004). The intensification of work, instead, has been associated with increasing expectations of performance and workloads (Piasna, 2018). Work intensification is not to be confused with work extension, which is longer hours and not necessarily the productivity within those hours. Mullan and Wajcman (2019) argue that this may be due to the fact that mobile devices can facilitate immediate notification, or checking, of work-related communications but may not lead to a sustained period of extra work time. In other words, this relates to the tendency to check on workplace communications while not actually executing any associated work tasks. However, this still allows for work-related stresses spilling over and contributing to an increased sense of time pressure for individuals (Mullan and Wajcman 2019).

23.3 Devices

The lower costs and widespread availability of mobile devices and communication networks have resulted in the increased use of mobile technologies in everyday personal and professional life (Leclercq-Vandelannoitte 2015). Leclercq-Vandelannoitte (2015) defines this consumerisation as the adoption and adaptation of consumer applications, tools, and devices in the workplace, as a means to carry out work tasks. ICT is now so prevalent in developed economies that an individual owning a laptop, smartphone and/or a PC is a basic presumption in many workplaces, to the extent that increasingly organisations have begun to initiate a bring your own device (BYOD) policy. This encourages employees to use a personal device for work-related tasks. Barlette et al. (2020) also point out that this can be a bottom-up phenomenon initiated by employees, where they use personal devices for both private and business purposes. From an organisational perspective, requesting employees to use their own devices can be advantageous in terms of cost and productivity, but simultaneously entails threats. For instance, organisational data on employees’ personal devices must comply with General Data Protection Regulations (GDPR). Barlette et al. (2020) note that the practice of BYOD must be implemented with the GDPR by employers.

In an educational context, a key shift in the education sector was the introduction of e-readers and tablet devices, to supplement or act in lieu of traditional textbooks. In the last number of years, we have seen the emergence of ‘tech’ driven schools which operate primarily on the use of devices – most usually tablets – as the primary learning resource in classrooms. Additionally, it is no longer uncommon for non-tech-driven schools to have a BYOD policy for students, with the expectation that devices will be required to complete homework or in order to review messages and content related to the completion of assignments. There is also an expectation that teachers too have access to technology. Presently, in Ireland, this expectation is dependent on the policy of each individual school. For example, in a typical ‘tech-driven’ school, it is possible to furnish staff with a complementary device as part of the school’s contract with an external technology provider. Non-tech-driven schools have been able to access funding to provide staff with a work place device. However, the provision of devices to all teachers in Ireland is certainly not mandated by the DES and is dependent on the internal policy of any given school. Hence, for many, BYOD is still a reality. In many schools worldwide, teachers invest in their own classroom resources such as stationery, DVDs, books, posters and classroom furniture. Therefore, this expectation is merely an extension of the school workplace culture whereby teachers must invest in their own resources with very little recompense, if any. The BYOD policy has long existed in some schools for teachers, particularly prior to the digital age when language and music teachers would frequently use their own cassette/CD players in class. Teachers typically used their own projectors in class for presentation purposes. Presently, many teachers are still using personal devices such as phones, laptops, visualisers and Wi-Fi speakers, although this is gradually being phased out due to recent GDPR legislation (Dunne et al. 2020).

One major change in the area of work, due the onset of mobile devices, is a greater flexibility to work from remote locations (Hill et al. 1998). Individuals are no longer tied to a specific location such as the school environment to deliver content. This can, however, have unintended consequences, such as the possibility of facilitating the aforementioned 'work-extension'. 'Work-extending technologies' and 'location independency' are emerging in both popular and academic vocabulary (Messenger and Gschwind 2016; Müller 2016). One of the biggest challenges for the individuals in today's society is balancing the demands of work and home life (Von Bergen et al. 2019). Greenhaus and Beutell (1985) define work family conflict as 'a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect'. This implies that meeting work expectations can interfere with personal life. Earlier in this chapter, we referred to the positive work–life balance often associated with teaching. However, technology facilitates the greater blurring of boundaries between school and home such that work commitments can spill over from the school day into personal time. Border theory (Campell-Clark 2000) suggests that when the borders between work and home are intentionally blurred, the achievement of work–life balance is much more difficult. Research has shown that an overlap between the boundaries of home and work can occur, with workers not being able to 'switch off' causing a negative impact on mental health (Grant, Wallace and Spurgeon 2013; Felstead and Henseke 2017).

23.4 Technostress

The term technostress has evolved significantly, but the term was first defined in the mid-1980s by Brod as the 'inability to adapt or cope with new computer technologies in a healthy manner'. Brod (1984) broke its manifestation into two categories: firstly, the difficulty in accepting computer technology and secondly, the over identification with it. It is the latter part of this definition that carries most traction today and it is our focus in this chapter. The idea of technostress was expanded on by Weil and Rosen (1997) as 'any negative impact on attitudes, thoughts, behaviours, or body physiology that is caused either directly or indirectly by technology' [2007, p. 316]. More recently, Tarafdar, Ragu-Nathan, and Ragu-Nathan (2007; Ragu-Nathan et al. 2008; Tarafdar et al. 2011) have explored the concept of technostress in great detail, defining technostress as 'stress caused by an inability to cope with the demands of organisational computer usage' and classifying technostress creators

Table 23.1 Technostress sub-factors

Technostress sub-factor	Definition
Techno-overload	ICT’s potential to force people to work more and work faster
Techno-invasion	ICT’s potential to invade non-work aspects of a person’s life due to the ability to be reached anytime, anywhere, making individuals feel like they are always connected
Techno-complexity	ICT’s potential to create anxiety for individuals when complex communication systems and jargon are used
Techno-insecurity	A situation where individuals feel their job or role is threatened by technology
Techno-uncertainty	The uncertainty caused by the rapid change and upgrading of technology resulting in an employee’s existing knowledge becoming outdated and constant retraining being required

Adapted from Tarafdar et al. (2007, 2011)

into five sub-factors. They are techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Table 23.1).

The aspect that we are particularly concerned with in the education sector is techno-invasion. Tarafdar et al. (2007, 2011) discuss the idea of pervasive connectivity stating that the pervasiveness of modern ICT often results in almost constant connectivity through email, the Internet, and the phone. Individuals feel that because they are always connected, they are ‘on call’. This creates within employees a sense that they have lost control over their time and space, which contributes to the development of stress. This new mode of working has created what Messenger and Gschwind (2016) label as ‘omnipresent connectivity’. Workers feel pressure or forced to respond in real-time to queries or demands that arise outside of working hours. Due to the cross-over between work and personal mobile devices, this can often be difficult to navigate in such a way as to keep a clear boundary between work and no work time. As discussed earlier, the BYOD culture means that having a separate ‘work’ device may no longer be the norm, for either teachers or students. For example, teachers checking their personal social media in the evenings may inadvertently see work-related emails on their mobile phone triggering a feeling of a need to respond.

23.5 Well-Being and Burnout

Tarafdar et al. (2007, 2011) argue that the adaption of ICTs is one of the most significant contributing factors to increasing stress levels. Kim et al. (2015) found that invasion of privacy was a significant source of work exhaustion. Yao and Cao (2017) showed that invasion of privacy had a significant positive impact on technostress. Technostress has also been described as a health and safety issue, causing physical ailments such as headaches, sleep issues, muscle cramps, back aches and high blood pressure (Brillhart 2004; Brod 1984) One of the most widely documented negative impacts of technostress is decreased job satisfaction (Ragu-Nathan et al. 2008; Tarafdar et al. 2011). This can have wide-reaching implications such as decreased organisational and continuance commitment. They define it as 'a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences'. (Ragu-Nathan et al. 2008). Prolonged chronic stress in a work environment can result in employee burnout. Reinecke et al. (2017) show a significant relationship between perceived stress and burnout. Technostress has also been linked with higher rates of absenteeism (La Torre et al. 2019). This aligns closely to high levels of turnover associated with job stress. Gender and age have been factors studied in regard to mobile phones and work–life balance: young female professionals with access to mobile phones are the most likely to be at high risk for burnout and negative family-to-work spillover when there are permeable boundaries at work, indicating that work and family boundaries are especially important for women (Chesley 2005). This is critically important, as teaching remains a largely female-dominated profession.

In a profession like teaching where engagement with the role is so critically important, the kinds of outcomes discussed here have serious consequences not just for teacher well-being but for student outcomes too. Therefore, these often-overlooked technology management-related aspects need to be considered by school management at individual school level but also we argue there is a role for state-led regulation in this area such that not only teachers are protected but that spillover effects on parents and students are addressed too.

23.6 Right to Disconnect

The European working time directive lists employee rights which EU member states should guarantee for all workers. These include a limit to weekly working hours (typically not to exceed 48 hours including overtime), a daily rest period (minimum of 11 consecutive hours of rest) and a paid annual leave period (minimum of 4 weeks per year) (EU's Working Time Directive 2003). The main aim of the directive is to lay out minimum health and safety requirements for organising working time. It defines working time as time that the worker 'is working, at the employer's disposal and carrying out his activities or duties'. However, the extension of the work day may not always be explicit, it can be subtle, for example, answering a work-related call in the evening. This seems harmless so the resulting consequence such as a lack of psychological detachment from work may go unaddressed (Derks et al. 2015). A new movement which has sprung up in response to this 'always on' culture is the 'right to disconnect' movement. This facilitates employees with the right to disengage from work and electronic communication after set work hours. The aim is to assist 'in defining specific boundaries between work expectations and family needs by establishing after-hours electronic communication schedules detailing when employees are accessible and can respond' (Von Bergen et al. 2019). Essentially, the right to disconnect is defined as the right for the employee to not be connected to a digital professional tool (such as a smartphone) during time off. In some aspects, the term 'right' is misleading in its use in the 'right to disconnect'. In essence, what the right to disconnect provides for is a right to negotiation in regard to how technological and connectedness aspects of work are managed. The right to disconnect legislation provides that employee contracts must include a negotiation of the obligations that are required of an employee regarding how connected they are (for work purposes) outside of office hours. Therefore, the legislation itself does not completely restrict after-hours work communication; instead, it obliges organisations to negotiate terms of contact clearly with employees. However, in a profession such as teaching where worker organisation and trade union recognition is strong, such regulation could have the potential to deliver significant change. Eurofound (2020) has classified the provisions addressing this issue in different EU Member States, ranging from those who have taken a 'balanced promote-protect' approach, for example, through introducing specific legislation around the right to disconnect (e.g. France) to those where 'no specific legislation' exist. Ireland forms part of this latter cluster. Unions in other sectors, such as financial services, have begun to call forms of right to disconnect legislation to be put in place in Ireland (FSU 2019). Employer representatives have been somewhat critical of the idea of any legislative introductions in this area; instead they argue that such issues be managed through organisational culture (Ibec 2020).

The emergence of organisational cultures, which either demand or institutionalise the use of technology to remain engaged with work outside of working hours, erodes the advantages that technology creates in relation to work–life balance. Furthermore, in order to consistently perform at optimum levels, physical distance and psychological detachment from work are vitally important (Mellner 2016), yet technology can make this substantially more difficult to achieve. In the case of teaching, this has consequences for teachers, and indirectly impacts multiple stakeholders in the education system. Yet, the issue of always-on culture or a right to disconnect has been notably absent among representative bodies as one of concern to this occupational group.

23.7 Spillover Effect: Examples of Technostress amid the Impact of Covid 19 on Teachers

Moving exclusively to remote learning exacerbated the already expanding workload associated with the recent digitisation of educational work discussed earlier in this chapter. Prior to moving online, mandatory digital tasks for secondary school teachers may have included: school report writing, maintaining personal records of exam results, creating as well as curating resources for classes, developing digital schemes of work and accessing email. Teachers may also have maintained a PLN (Personal Learning Network) on social media in order to scaffold CPD and professional learning. However, the face-to-face nature of school teaching as well as working on hard copies of submitted student work dominated many teachers' contracted teaching hours and typically characterised their strategies to support learning and well-being in this context. Recent work by researchers in Ireland has highlighted the additional stresses experienced by educational stakeholders when working remotely in order to provide continuity of learning during the pandemic (Mohan et al. 2020; Devitt et al. 2020; Hourigan forthcoming). Teachers primarily reported a huge increase in workload within the online environment. School work days are typically quite rigid in structure, with lessons scheduled at precise times according to the timetable, with auditory cues in the form of the school bell to support transition between subjects and classes. However, teachers reported much longer working days in an environment devoid of both physical and auditory boundaries, with greater emphasis on digital administration than what would have been experienced previously. Hence, rebuilding a school community from the ground up within an unknown virtual world impacted greatly teachers' work–life balance. The main concern amongst teachers at the start of lockdown was to establish contact with students and for most in the profession, this was via their own personal device. Hence, it was unavoidable to prevent one's work environment converging upon their established space reserved for personal and recreational activities. Professional standards of presentation would have been expected in this context and it may have been necessary for some to consider a 'spring clean' of their desktop to protect privacy. This was with the knowledge that teachers would be sharing screens on their personal devices with pupils for either live or recorded lessons. For many teachers, this presented a significant challenge, particularly if their teaching preferences were non-digital prior to the school closures. Technostress was reported across a wide range of experiences, with particular reference to upskilling for those with very basic digital skills. This level of techno-uncertainty resulted in the provision of introductory ICT courses for teachers provided by the PDST (Professional Development Service for Teachers) technology in Education division. Teachers were invited to participate in these during their free time. In an increasingly feminised profession, emergency CPD during a pandemic would have undoubtedly placed pressure on out-of-work caring commitments. In terms of delivery of lessons, there was an expected onus on teachers initially to deliver classes synchronously via platforms such as Zoom and MS Teams. As this was uncharted territory for many, acquiring the digital skills to deliver the content whilst dealing with classroom management issues added to the intense pressures experienced by teachers in this situation. The technical invasion into teachers' homes was another factor to consider, with the pressures of 'camera on' policies reported in some schools exerting pressure on teachers and students from lower socio-economic backgrounds alike. As aforementioned, administrative load emerged as a primary source of stress for teachers. As many schools strove to maintain their school timetables, additional duties such as pastoral care increased, as schools tried to establish contact and support with families unable to engage with online classes. Emergency meetings after school time were also an additional factor as teachers scrambled to deal with additional emails and messages across different platforms from students requiring support. In addition, collegial support in the form of ad hoc training sessions was also a feature of how teachers supported each other, often taking place at weekends or long after classes had ended.

23.8 Spillover Effect: Technostress and the Impact of Covid 19 on Students

Kasuga et al. (2004) also showed a connection between technostress and anti-social behaviour on computers. Studies by Livingstone et al. (2018) and Harding (2014, 2019) highlight the absence of policy and support for parents in terms of advice on privacy, protocol and safety issues. Parents also need help in finding and evaluating the best online educational material for their children. In the wake of Covid-19, schools and universities in Ireland closed in March 2020 and did not open again until September 2020. This emergency closure meant that the ideal phased approach of introducing technology into teaching and learning was not an option. Many schools found that they had to engage in an emergency adoption of technology. One of the consequences of such a rapid pivot to online teaching and learning meant that there was no time to create and establish a policy with clear guidelines on the use of technology. An emerging issue for teachers and students, coping in the new face to face pandemic teaching environment, was that there was a clear need for students to be supported at home. Thus, the Working from Home culture of the parental world became deeply enmeshed within the chaos of children's remote learning, culminating in layers of temporal and device boundaries being destabilised.

Techno-invasion was noted as being particularly problematic in this domain. Before the school closures across the world, some households had a digital policy in place with a clear set of rules for the use of devices in the home (Hayman and Coleman 2016; Chen and Garrison 2020). Some parents also had family media plans (Korioth 2016) that included screen time limitations and a curfew for the use of Wi-Fi. Households with plans in place were in a better position to navigate through the first few weeks of the school closures where many teachers and students reported that they found themselves in an 'always-on' mode. During the first few months of Covid-19, both social and traditional media outlets reported on teachers, parents and students feeling particularly stretched due to this intense techno-intrusion. Kahu (2013) has highlighted the challenges for third-level students associated with trying to balance the life load with their studies. The school closures meant that all students were supposed to engage to some extent with remote teaching and learning activities. The life load that Trowler (2013) highlighted became more pronounced for all stakeholders and students at second level were also experiencing more demands on their time due to the intrusive nature of technology.

Of course, it would be naive to think that students never worked late into the night on assignments or reading the class materials. However, as much of this late night work was now being done on a device there were potentially more serious consequences for their health (Hussaindeen et al. 2020; Sheppard and Wolffsohn 2018; Renard and Leid 2016). This example of techno-complexity emphasised the range of skills needed to complete tasks in a successful and timely manner. Processing the material by device while convenient may contribute to long-term poor habits regarding how information is processed and retained and distraction is also a major concern for many (Stavanger Declaration 2019; Schilhab et al. 2018; Schilhab 2017; Dunne et al. 2020). The pandemic also created a huge hidden extra digital administration load for students. Many students found that it was also harder to effectively reference from the book when they were using photos of text and teachers anecdotally reported that student management of materials was difficult with some students effectively using a camera roll as a copybook. In this new world order, this practice demands a whole new set of organisational and management skills which has not been required or nurtured before now. Parents also face some of this extra administration load. Instead of a hastily written note from a parent to excuse a student from class or to explain an absence, parents now have to write an email or log in to a school app and respond to an absence notification. This type of communication is more formal and notifications from school could potentially get lost in the ocean of online communication traffic. However, there is evidence in the literature to support such communication as having a positive impact on parental involvement and classroom management (Cheng and Chen 2018).

During the physical school closures, another issue that many reported on social media was the modification of existing school timetables which contributed to substantial techno-overload. There was a tension around the perceived value of synchronous and asynchronous teaching (Ferdig et al. 2020). During the early stages of the closures, many parents and students felt that they should be receiving synchronous teaching with many stakeholders assuming that even haphazard synchronous teaching was superior to meticulously planned and recorded asynchronous activity. This continues to be a divisive topic. At the time, the complex and fast-paced environment led to increasing reports of techno-insecurity. In an effort to try and meet the educational needs of all students, many school principals removed a number of non-exam subjects from student timetables, including physical education (Dunton et al. 2020; Mohan et al. 2020). Reducing the non-curricular load was seen as necessary during this time of crisis in order to allow students adequate space to adjust to their new learning environment. This additional time would have been of immense help to students as they navigated the additional administrative tasks synonymous with learning, preparing and submitting working online. Currently, as schools worldwide plan best practice in terms of student workload and remote teaching, it is important to remain cognisant of the need to respect allocated and prescribed teaching times. This would include providing adequate CPD to teachers on how to integrate synchronous and asynchronous teaching solutions during their allocated teaching periods and to avoid the potential pitfall of exploiting any ‘freed up’ slots as space for extra teaching. This is yet another example of identifying the importance of fortifying temporal boundaries if and when schools return to remote teaching. In some subjects where face-to-face interaction may have been required, the question of camera-on/camera-off protocol emerged as an important consideration. Subjects such as modern foreign languages and music would have experienced such

Table 23.2 Technostress applied to pandemic remote teaching and learning

Technostress sub-factor	Teacher context	Student context
Techno-overload	Erosion of work/life balance Temporal boundaries deactivated Pressures from students to provide feedback on electronically submitted work	Modification of timetable -extended learning time Varying expectations with regard to work submission
Techno-invasion	Out-of-hours contact by students No digital curfew Availability for emergency meetings Camera-off/-on policy	Out-of-hours contact by teachers No digital curfew Availability for digital training sessions Camera-off/-on policy
Techno-complexity	Too many apps for teaching; learning and administration Pressure on novices to adapt quickly to digital teaching Lack of time and support to trial apps Lack of experience in trialling apps for feedback	No clear communication policy Multiple email accounts (school, personal, parental, external provider) Lack of time to learn how to integrate apps Inconsistency with device and task
Techno-insecurity	Professionalism undermined due to inexperience with remote teaching Ability to deliver feedback threatened by lack of digital expertise	Pressure to submit high-quality work may have resulted in plagiarism issues due to unmonitored use of the digital solutions Pressure on non-exam years to perform well in order to have good results on file
Techno-uncertainty	No time to develop teaching methodologies appropriate to remote learning Reduced access to models of best practice due to social and professional isolation	No time to develop learning strategies to adapt to remote learning Limited opportunity to work in groups for peer learning opportunities

Adapted from Tarafdar et al. (2011)

challenges in establishing appropriate assessment guidelines during initial lockdown.

This is uncharted territory for education. Schools are now open in Ireland, allowing us to identify all aspects of these aforementioned sub-factors as outlined in Table 23.2. What we see is an emerging and oscillating post-lockdown spectrum of technostress experiences. We can identify an independent and separate range of roles and identities that both students and teachers must assume. School cultures of 2020 are completely unrecognisable from the school environment of 2019. Clearly, these levels of techno-overload and techno-complexity are unsustainable. Teachers and students simply do not have the cognitive capacity to work in this manner without support from the Department of Education and Skills. Clearly, issues of technostress and the right to disconnect have emerged as crucial themes when considering the well-being of education stakeholders, particularly students, teachers and families. Such factors are presently having a profound effect on reshaping the educational landscape, particularly regarding the demands of remote teaching and learning.

23.9 Conclusion

Ireland's Economic and Social Research Institute (Mohan et al. 2020) surveyed school leaders on their experience of addressing the challenges arising from the sudden switch to remote learning. This research highlighted that the ability of schools to act 'was impacted by schools' prior adoption of technology, and the level of access to digital technologies and broadband availability in their catchment areas'. Many schools had to provide some form of ICT equipment to students, particularly to disadvantaged groups. Covid-19 has revealed two plain facts. Investment in education in Ireland has been severely lacking. The funding is expected to complement the objectives of a school's Digital Learning Plan to which the Department of Education and Skills has provided considerable resources and supports under the Digital Strategy. However, it should be pointed out that, even with these funding announcements, in 2016, Ireland invested just 1.2% of its GDP on second-level education compared to the OECD average of 2% (Marcus-Quinn et al. 2019) and schools have a high level of autonomy in terms of how they implement a digital strategy for their school community.

The Education Act (1998) is a key policy document in Irish education, emphasising the rights, roles and responsibilities of key stakeholders, including parents, teachers and pupils in schools (Harrison et al. 2016). There is an impetus on all stakeholders to begin to shape regulation in regard to technology use which will ensure better outcomes for teachers, students and parents. These arrangements risk becoming normalised as part of the career path of young teachers. Wilmore and Betz (2000) point to the important role of school principals in the successful adoption of technology in schools; here we argue that another important role of the principal is in enforcing and/or establishing policy which supports the healthy adoption of technology outside of school hours by both teachers and students. While trade unions have been effective in curtailing the length of the working week during much of the twentieth century, there has been mixed contemporary evidence on their role in influencing working time amid the onset of technology. The right to disconnect is one way that has been proposed. However, to date, there has been little discussion of such initiatives among teacher-specific representation bodies.

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