# Chapter 3
# Agile PBL and the Next Generation of Learners

## Introduction

In Chap. 2, we outlined our vision and model for an agile PBL ecology for learning. A key challenge we are aiming to address with agile PBL is the next generation of learners, both in terms of what skills they bring and what skills they need. This chapter explores the characteristics of a new generation of students and the idea of twenty-first-century skills. The particular emphasis here is how the two are, or should be, aligned and how an agile PBL provides opportunities to both draw on skills that a new generation of learners brings to the universities and empower these learners with the skills and attitudes they need to succeed upon graduation. An agile PBL ecology for learning allows us not only to recognise the myriad of factors, elements and layers that impact on learning but also to respond to these in both a responsive *and* proactive way, so that the learning environment is optimised for everyone involved.

With the first decade of the twenty-first century well behind us, the universities in general are facing a situation where they are expected to 'educate' more people from wider and more diverse backgrounds than ever before (Bradley, Noonan, Nugent, & Scales, 2008; James, Krause, & Jennings, 2010; Oblinger, 2010; Thomas, 2002). Yet, models of education in the university have arguably not changed in any fundamental way since the 1800s (Goodchild & Wechsler, 1989). As Tapscott and Williams (2010, pp. 18–19) argue, the current model of pedagogy, which is at the heart of the modern university, is fast becoming obsolete. In the industrial model of student mass production, the teacher is the 'broadcaster'. A broadcast is, by definition, the transmission of information from transmitter to receiver in a one-way, linear fashion. Broadcast learning may have been appropriate for a previous economic environment, and a previous generation, but increasingly it is failing the needs of a new generation of students who are about to enter the supercomplex world of uncertainties.



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Tapscott and Williams (2010) go on to develop their case for what they call 'collaborative learning', which they equate with 'social learning'. This creates an interesting link to PBL approaches to learning, which are inherently 'collaborative' and 'social'. PBL has been a notable exception to 'broadcast learning' since its introduction in the 1960s, and it was at a time of radical departure from the teacher-centred models. However, it has been relatively confined to particular disciplines, even if it is inherently designed to work on an interdisciplinary level. An additional element in the twenty-first century is the increasing ubiquity of digital technologies, both in the workplace and in educational contexts. It is urgent and crucial that universities adapt to changing patterns and contexts of education and work for two related reasons: firstly, to be able to adequately prepare their students for the needs of the twenty-first-century workplace and wider context and, secondly, to respond to and engage with the skills and characteristics that students bring to the educational environment. In short, it is urgent for universities to stay *relevant* and survive in a higher education context where online offerings are increasingly becoming the norm, which in turn means that universities can no longer depend on their physical location or traditional funding models to operate and add value to the society in which they are situated. Indeed, as we have begun to argue, they need to engage in much more deeper, responsive and agile ways to a wider learning ecology in which they are a part of and situated.

Barrows' PBL model is often lauded as an 'authentic' approach to learning (Wee & Kek, 2002) and 'authentic' in terms of our day-to-day environments, both at work and personal, and it has been increasingly characterised by a blend of face-to-face and technology-supported contexts. This fits with Barrows (2002) definition of PBL discussed in Chap. 2, which includes the central proposition that PBL is an education process that requires the learner to go through the same activities during learning that are valued in the real world. In other words, it is no longer a matter of *whether* to use technology to support PBL teaching approaches or PBL curriculum, but rather a matter of *how* to design a PBL curriculum, which entails the teaching approach, learning process, assessments, learning environment, problems (content) and evaluation, in the most effective manner *with* technology in an integrated manner. In other words, the question is how to rejuvenate PBL curricula for the twenty-first century and how to make it more agile, without compromising its fundamental principles. As Rotherham and Willingham (2010, p. 20) put it, 'devising a twenty-first century skills curriculum requires more than paying lip service to content knowledge'. This leads us to the central point of this book: fundamental PBL principles or spirit does not need to be compromised because they are very well suited to deliver the kind of learning outcomes that are generally considered to be needed for the contemporary *and* future workplace.

In terms of the latter, it is interesting, for example, that some educators are already beginning to talk about social media literacies (Rheingold, 2010), and new literacies will be needed as technologies continue to evolve at a rapid pace. In this twenty-first-century context, it is not important what students can do with a particular digital tool or suite of tools, but rather how fast they can learn to use new tools and adapt to fast-changing circumstances, including the ability to identify

entrepreneurial ways of leveraging new technologies (Macmahon & Huijser, 2015). This is what we call a way-of-being or adaptive expertise throughout this book.

Research in learning sciences has emerged highlighting two major forms of expertise – routine expertise and adaptive expertise (Bransford et al., 2006). Adaptive expertise is a form of expert knowledge that can support 'continual learning, improvisation, and expansion' (Bransford et al., 2006) or, in short, open up innovations in society. Adaptive expertise is a concept first observed and studied by Hatano and Inagaki (1984). In contrast, a 'routine expert' refers to a person who is efficient and accurate and becomes even more efficient and accurate through time when addressing familiar problems. This form of expertise is developed through the repeated application of procedural knowledge on the same tasks or problems, i.e. with a well-established pattern or modes of processing a task or problem. However, this form of expertise is adequate in a context where the problems are similar, with familiar or constant variables surrounding the problems. The challenge here is around what happens if the student has not gone beyond procedural efficiency. Routine experts, even though they may have declarative knowledge and they may apply procedural knowledge repeatedly to address problems at hand, appear to perform without much understanding (nor reflection) and exploration or experimentation beyond the familiar (Hatano & Inagaki, 1984). This becomes a problem in an environment where the problems change continuously and, furthermore, where there is an increasing need to anticipate potential problems (and how to address them) either in advance or as part of entrepreneurial planning. This is where a 'way-of-being' becomes a salient part of becoming adaptive experts, which is what we would like to think of our graduates when they leave university.

Adaptive experts are more likely to go beyond routine competencies with variations, rather than in terms of speed and accuracy of solving familiar problems (Hatano & Inagaki, 1984). These experts apply their conceptual schemas in a more adaptive manner due to their understanding of why their procedures work; they also modify known procedures or even invent new procedures by responding in a flexible manner to contextual variations (Hatano & Inagaki, 1984), making them more flexible and innovative and indeed more agile. This is precisely what we want in twenty-first-century learners – to be adaptive and flexible as they traverse from the university to the supercomplex world of super uncertainties. However, it requires an educational landscape that allows them to actively explore, experiment and reflect (Hatano & Inagaki, 1984; Hatano & Oura, 2003) and that would eventually lead them to continually adapt to change (Hatano & Oura, 2003). However, for such learning to be reached and attributes to be developed, and to receive the full benefits from an agile PBL, we argue that it needs to be applied in a consistent manner across an entire curriculum, rather than in a piecemeal fashion or in isolated pockets. Naturally, this is not an easy task and requires a monumental shift in attitudes in the short term, but we argue that such a shift is ultimately inevitable and indeed desirable. By not focusing on a way-of-being, preparing students for future learning (Bransford & Schwartz, 1999), and by not changing the pedagogy and curriculum, we run the risk of educating pseudo-experts at best – students whose expertise does not mirror the expertise needed for real world, thinking inside or outside the

academic disciplines and knowledges, and students who lack what Sternberg (2003) calls successful intelligence.

## Why *Not* Problem-Based Learning in the Twenty-First Century?

It is relatively easy to make a theoretical argument about why PBL is a good approach to teaching in the twenty-first century as it appears to tick all the right boxes such as graduate attributes, learning outcomes, student engagement and student success and positive and significant educational student experiences. The key skill required in the twenty-first century is the ability to deal with a massive amount of information and turn this information into 'knowledge', that is, the ability to critically select and manipulate information and creatively repurpose it for whatever context it needs to be applied to. Moreover, it increasingly requires the ability to recognise and anticipate *potential* contexts for which that information may be repurposed, which calls for entrepreneurial skills. The latter does not necessarily mean 'to start an enterprise', but rather to have an entrepreneurial attitude in all aspects of life, including in a workplace. In an educational context, Jaros and Deakin-Crick (2007) explain it as follows:

> Instead of expending their learning power on rote-storing of solutions to eternal problems and 'facts', students must acquire methods of retrieving and manipulating knowledge and information. They must be able to recognize and manage their own learning processes and pathways, defining them in terms of simple local parameters, and sharing them with others on a time-scale dictated by the event itself. They must be able to learn while working on the problem and to use self-assessment to control the direction, intensity, and standard of their work. (p. 424)

This does not merely signify a minor change in education, which can be addressed by tweaking the way we teach and adjusting our approaches to teaching around the edges. Rather it signifies what some call a paradigm shift, as illuminated, for example, by Wee and Kek (2002) in their use of PBL to 'transform' marketing education to better prepare students for the world of marketing. Deakin-Crick (2007, p. 137) notes that 'this paradigm shift is towards a relational and transformative model of learning, in which the creation of interdependent communities of intentional learners provides a basis for the integration of "traditional academic" skills and outcomes with the learning dispositions, values and attitudes necessary to meet the demands of the emerging "networked society"'.

Similarly, Şendag and Odabaşi (2009, p. 132) argue that 'today's working conditions have required fundamental changes in the profiles of work power, which basically stemmed from the rapid change and transformation in the nature of information'. They expand on this by stressing the ability to think critically, especially in the context of technological change, for 'technological changes along with the changes in the workplace have made critical thinking abilities more important than ever before' (Sendag & Odabasi, 2009, p. 132), to which we can add the ability

to creatively apply knowledge in ways it has not been applied before (Huijser & Kek, 2016).

The Partnership for 21st Century Skills collective has developed an extensive framework for twenty-first-century learning (2009) which outlines in great detail the kinds of skills, literacies and attitudes that may be required. They usefully split these into four main themes, with a series of related skills and literacies:

- *Core subjects and twenty-first-century themes*
  - Global awareness
  - Financial, economic, business and entrepreneurial literacy
  - Civic literacy
  - Health literacy
- *Learning and innovation skills*
  - Creativity and innovation
  - Critical thinking and problem-solving
  - Communication and collaboration
- *Information, media and technology skills*
  - Information literacy
  - Media literacy
  - Information, communications and technology (ICT) literacy
- *Life and career skills*
  - Flexibility and adaptability
  - Initiative and self-direction
  - Social and cross-cultural skills
  - Productivity and accountability
  - Leadership and responsibility

These themes, skills and literacies are echoed in the more recent 'Elements of the Creative Classroom Research Model' (Johnson, Adams Becker, Estrada, & Freeman, 2014, p. 4) which, as part of the *NMC Horizon Report*: *2014 Higher Education Edition*, focuses on innovative pedagogical practices and details all the elements that are involved in such practices. The model has 8 themes and 28 related elements, which overall are consistent with what fundamentally characterises a PBL teaching and learning system:

- *Content and Curricula*
  - Emotional intelligence
  - Cross- and transdisciplinary
  - Open educational resources
  - Meaningful activities

- *Assessment*
  - Engaging assessment formats
  - Formative assessment
  - Recognition of informal and non-formal learning
- *Learning practices*
  - Learning by exploring
  - Learning by creating
  - Learning by playing
  - Self-regulated learning
  - Personalised learning
  - Peer-to-peer collaboration
- *Teaching practices*
  - Soft skills
  - Individual strengths
  - Multiple learning styles
  - Multiple modes of thinking
- *Organisation*
  - Monitoring quality
  - Innovative timetables
  - Innovating services
- *Leadership and values*
  - Innovation management
  - Social entrepreneurship
  - Social inclusion and equity
- *Connectedness*
  - Networking with real world
  - Social networks
  - Learning events
- *Infrastructure*
  - ICT infrastructure
  - Physical space

In the meantime, research on student development in higher education in general shows that the more time and energy students devote to educationally purposeful activities, the more they are engaged (Astin, 1993; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007; Pascarella & Terenzini, 2005). This research implies that the more universities can create purposively designed learning environments that channel students towards highly engaging learning and activities, the more these institutions would have created the conditions for their students' success, as it relates to student

satisfaction, learning and development of learning outcomes and persistence (Astin, 1993; Pascarella & Terenzini, 2005). Chickering and Reiser's (1993) vector of development, which is an extension of Chickering's (1969) work on education and identity, suggests that students move through a number of psychosocial development phases termed 'vectors' during their university studies. Students navigate these vectors at different rates, often not sequential and often reiterative, but regardless, they do form 'major highways for journeying toward individuation' (Chickering & Reisser, 1993, p. 35). PBL learning processes and activities, when designed well, could also be seen as travelling along these vectors of development, requiring reiterative learning processes; complicated problems; going over the process again and again until it becomes second nature to students; representing the identities of PBL students as competent problem-solvers, independent and self-directed; and critically applying and creating knowledge to be able to manage today's world of complex and mixed demands of work, business, social and personal lives. However, the most convincing argument for why PBL ideally suits today's university contexts lies in Chickering and Reiser's 'three admonitions' of, firstly, the integration of work and learning; secondly, recognition and respect for individual differences; and thirdly, acknowledgement of the cyclical nature of learning and development.

In this way, PBL can be seen as having the potential to simultaneously facilitate and respond to the paradigm shift laid out above. An often cited strength of PBL initiatives is that they facilitate the development of transferable or 'soft' skills (sometimes called 'employability skills') such as teamwork, communication, information literacy, critical thinking, lifelong learning, problem-solving, self-management, planning and organisation and innovation and enterprise (Kek & Huijser, 2011; Moore & Poikela, 2011). On a global level, many employers identify such transferable skills as more important than technical skills or factual knowledge (Drohan, Mauffette, & Allard, 2011). PBL as a pedagogy and curriculum potentially opens the universities to better address these needs and to move away from more traditional transmissive models to learning and teaching, which are often purely focused on the transfer of declarative knowledges. Majoor and Aarts (2010, p. 249, our emphases) cite the following summary about higher education by the World Bank:

> The world today is increasingly dependent on knowledge and therefore on people who are capable of *generating* and *applying* knowledge. Thus, the potential of a society to develop is critically related to the comprehensiveness and quality of its educational system and rate of participation of the population in that system.

Again, the emphasis here is on *generating* and *applying* knowledge, rather than reproducing it, which is what more traditional transmissive approaches focus on. Majoor and Aarts (2010) further argue that the problem with traditional teaching approaches is not only that the knowledge thus acquired is static but more importantly that it is often outdated in a global context in which knowledge changes rapidly. They note that the qualitative challenges in education have their roots in the traditional transmissive tradition, which continues to dominate education in many developing countries and is not being adjusted to the changing needs of society (Davies, Fidler, & Gorbis, 2011; Majoor & Aarts, 2010), at least not fast enough.

Thus, there appears to be little debate about the proposition that PBL is a pedagogy and curriculum that has the *potential* to empower graduates with twenty-first-century skills, even if there is significant debate about whether the evidence actually supports this (Archetti, 2011). However, this raises two key questions: how do you ensure the desired learning for all students, and how do you integrate technology into this process in meaningful ways? In terms of the latter, Savin-Baden (2006, p. 10) has argued that 'problem-based learning and surfing the internet share similar qualities, for example the process of learning in problem-based learning teams is interactive, non-sequential, random, and often seems rather chaotic'. This in turn puts a significant amount of pressure on teachers: the PBL process has the potential to make teachers feel profoundly uncomfortable, and indeed it often does. Savin-Baden (p. 10) identifies the conflict for teachers as arising in the need for them to allow students 'freedom to manage knowledge, rather than keeping their previous roles and relationships with students as the controllers and patrollers of knowledge'.

For many teachers, PBL can mean a major 'culture shock' and requires a change in attitude and approach that goes to the core of their identity as teachers. This is precisely why PBL is difficult to implement in a consistent manner across an entire educational institution or, even less ambitiously, across a particular faculty, program or course. However, if we accept that PBL has the potential to develop twenty-first-century skills in students, then it is crucial that their teachers either already possess such skills themselves or are at the very least willing and open to 'teach' such skills or 'teach' a curriculum designed with a set of learning outcomes that comprise both skills, or procedural knowledge and declarative content knowledge, compared to a curriculum that teaches only the discipline knowledge or content. In other words, teachers need to be lifelong learners themselves and be comfortable opening up and operating in a world where there is an abundance of information, but which is at the same time 'non-linear, random and chaotic'. Şendag and Odabaşi (2009, p. 135) stress the importance of training teachers who have critical thinking, problem-solving, collaboration and networking skills, which they argue is 'a must in the current century'. This is important, because the role of teacher is often considered to be crucial in a PBL context (Kek & Huijser, 2011; Luck & Norton, 2004; Martyn, Terwijn, Kek, & Huijser, 2014; Omale, Hung, Luetkehans, & Cooke-Plagwitz, 2009), especially when students are first exposed to PBL. The preparation of teachers who are comfortable in both a PBL context and in online environments is therefore a vital part of ensuring that PBL delivers on its promise of developing students who are self-directed, lifelong learners, or what Black, Mccormick, James, and Peddler (2006) call 'intentional learners'. In a context where learning in higher education appears to be increasingly heading into learning and teaching environments rich with technologies (Davies, 2012; Johnson et al., 2014), blended forms of PBL learning environments, and various PBL constellations (Savin-Baden, 2014), offer the potential to prepare students for such significantly changed learning environments, and more importantly to equip them with the tools to get the most out of such learning environments. A related issue here concerns a new generation of students, and their characteristics; in other words, not only are current teaching

practices outdated in many ways, and particularly in terms of their learning outcomes, but they may also be inappropriate in the way they target a new generation of students.

## The Digital Generation

At this stage, it is important to draw attention to our use of the terms 'next generation of learners' and 'the digital generation'. It would be relatively easy to confuse this term with the widespread use of the terms 'digital natives' (Prensky, 2001) and 'net generation' (Oblinger & Oblinger, 2005). We will thus call this new generation of students the 'digital generation', to capture their engagement with, and immersion in, digital tools, rather than their age. As noted, much has been written about what is variously called Generation Y, the net generation (Oblinger & Oblinger, 2005), Millennials (Sankey, 2006) and digital natives (Prensky, 2001). Much of this writing however has a high 'hype factor', in that it presumes a radical break with the past. Prensky, for example, argues that 'our students have changed radically. Today's students are no longer the people our educational system was designed to teach' (para.1). He claims that 'today's students think and process information fundamentally differently from their predecessors' (2001, para. 4). This sets up a binary between students (digital natives) and teachers (digital immigrants). Ultimately, this then leads to his central question: 'should the digital native students learn the old ways, or should their digital immigrant educators learn the new?' (Prensky, 2001, para. 17). While this is clearly a deliberately provocative question, it has the unhelpful side effect of reinforcing an either/or binary, by simplifying both the category of 'student' and 'educator', thereby not only ignoring an increasingly diverse student population but also closing the door on the possibility that skills associated with digital natives could be acquired at a later stage, or at least appropriated in different, yet meaningful ways (Huijser, 2006), and that such skills could therefore also apply to mature age students, for example. Prensky and other proponents of the 'digital native thesis' have been widely critiqued for using overgeneralisations, but the key characteristics of digital natives that are identified include: digital natives prefer images over text; they prefer games over 'serious work'; they function best when networked; they can't pay attention (or choose not to); and finally, they have perfected their digital technologies-related skills (Koutropoulos, 2010; Oblinger & Oblinger). Some of these claims are supported with some evidence, even if it is somewhat tenuous. Sontag (2009), for example, draws attention to some evidence that social changes associated with technology use by teenagers (a 'generation of learners enmeshed in connective technologies', p. 1) impact on cognitive processes. The key point to make here, however, is that the next generation of learners is highly heterogeneous, in terms of access to digital technologies, use of digital technologies and applied skills in this regard. In other words, while there is clearly a highly divergent use of digital technologies, a basic level of use of digital technologies is nevertheless near-universal.

Basically, Prensky's argument is largely positional in nature and not based on specific empirical research (Koutropoulos, 2010), and it has attracted a lot of critique since it was first introduced (Bennett & Maton, 2010; Burton, Summers, Noble, & Gibbings, 2015; Jones, Ramanau, Cross, & Healing, 2010; Kennedy, Judd, Dalgarnot, & Waycott, 2010). As noted above, the idea that there is a homogeneous generation of students has been widely debunked as a myth, even if it persists as a popular notion. For example, Jones et al. (2010, p. 722) note that 'the generation is not homogeneous in its use and appreciation of new technologies, and there are significant variations amongst students that lie within the Net generation band'. More recently, empirical research is beginning to appear which cuts through some of the hype associated with this 'digital generation' (Kennedy, Judd, Churchward, Gray, & Krause, 2008; Kvavik, 2005), and it is beginning to show its heterogeneity in more detail (Czerniewicz & Brown, 2010; Harigittai, 2010; Oliver & Goerke, 2007). While these studies confirm that the digital generation has grown up in an environment 'saturated' by technology, they also suggest that there is much variation in terms of types of use, associated skills and, importantly for our purposes here, preferences for use in education. A large Australian study by Kennedy et al. (2008, p. 108) shows that 'many first year students are highly tech-savvy. However, when one moves beyond entrenched technologies and tools (e.g. computers, mobile phones, email), the patterns of access and use of a range of other technologies show considerable variation'. For example, while Kennedy et al. (2008) found a significant growth in students' general use of instant messaging, blogs and podcasting, they also found that the majority of students rarely or never used these technologies for study, and importantly, 'the transfer from a social or entertainment technology to a learning technology is neither automatic nor guaranteed' (Kennedy et al., 2008, p. 119). In a related study that builds on this evidence, Kennedy et al. (2010, p. 339) make a distinction, based on their empirical data, between what they call 'power users' (advanced technology users) (14 %), 'ordinary users' (27 %), 'irregular users' (14 %) and 'basic users' (45 %). The largest group, basic users, was 'rudimentary technology users, who used only standard web-based applications and mobile phones on a relatively frequent basis' (p. 339). In other words, the Prensky's (2001) 'digital natives' are more likely to be the exception rather than the rule.

However, in terms of outcomes, it is important that we strive for 'digital native'-like competencies. In other words, in the apparent scramble to appeal to the digital generation, there is often no direct engagement with what they *should* be able to do as part of their learning journey, and how this should be applied and adapted to work or entrepreneurial environments. As Koutropoulos (2010, p. 526, original emphasis) argues, for example, 'digital natives *should* also exploit that physical ability to learn to function in environments that don't necessarily have the tools that they are used to'. He goes on to question a range of other assumptions that are associated with the digital generation: 'the fact that one can mechanically go through the motions of searching for someone on Google doesn't mean that they possess the critical literacy and information literacy required to determine which results were quality results' (2010, p. 527). Interestingly, it is at that level of learning, and what we are calling twenty-first-century skills, that PBL is at its most powerful, because of two

reasons: Firstly, an inherent part of the PBL process is identifying and exploring prior skills, as they are relevant to the PBL problem, so this means recognising the diverse skills that the digital generation brings to the classroom (e.g. those skills acquired in the meso- and macro-contexts of their learning environments) and leveraging those skills as part of the learning process. Secondly, the PBL process is outcomes driven, which means that a well-designed PBL program does not assume anything, but does clearly define the exit skills and actively works towards developing those skills.

## Towards an Agile PBL

So far we have identified the potential relevance and outcomes of PBL and the need for teachers to acquire the skills to activate the type of learning to occur in a PBL context, on a theoretical level. However, there is a large gap between the theory and the practice, especially because PBL has the biggest potential impact if it is seen as a holistic pedagogy and curriculum, rather than as one of many teaching techniques that can be addressed in isolation. If we consider this in the context of an agile PBL ecology for learning, it becomes clear that nothing in such an ecology works in isolation. Thus, applying PBL in isolation would not have achieved any of the desired intentions that we are identifying here. Any rewards, however small, from PBL can be achieved by intentional design of the pedagogy and at the curriculum level. This is the key point and one that is often overlooked in the critiques of PBL. Most of the empirically based studies of PBL are based on individual units of study or courses. They are often case studies produced by teachers who are PBL enthusiasts or who are experimenting with PBL (Brodie & Gibbings, 2007; Huijser & Wali, 2012; Omale et al., 2009; Yeh, 2010). The results of such studies are often difficult to generalise, and they often create perceptions of benefits, rather than hard evidence about learning outcomes. It is therefore no coincidence that the main critiques of PBL are often levelled at the perceived lack of evidence for the benefits claimed (Eck, 2002; Sanson-Fisher & Lynagh, 2005). Archetti (2011), for example, asks the following provocative question: 'are teachers simply deriving the expected benefits from the characteristics of PBL activities rather than from the evidence of students' learning experience?' Our response to this question is twofold. Firstly, the question is based on an earlier mentioned traditional, and arguably outdated, conceptualisation of knowledge, rather than on the types of skills that most of the claims about PBL benefits relate to. This is what Jaros and Deakin-Crick (2007, p. 424, original emphasis) refer to when they discuss a 'new approach to curriculum structure and delivery, and a new style of benchmarking in which the competencies and the learning outcomes are *supported*, rather than led, by subject knowledge'. PBL is such an approach to both curriculum structure and delivery and should therefore be measured as such.

Secondly, the direct learning outcomes, in the form of transferable skills, are not the type of skills that can be developed in isolation in a single course or unit of

study. Instead, they are the type of skills that will only be further developed progressively if a consistent intentional pedagogy, across an entire curriculum, is implemented, as they involve learning of knowledges, skills and dispositions that cannot be easily measured in the form of an exam in one sitting. A whole-of-institution approach is therefore a critical element of leveraging the potential benefits of PBL, but this demands significant organisational commitment and resources, and the types of critique outlined above, though flawed, create a barrier to such organisational implementation of PBL. Not only that, we argue throughout this book that an agile PBL pedagogy and curriculum do not just take place in a traditional classroom context but aim to move the PBL problems into authentic contexts (i.e. into the macro-context), such as workplaces, communities and society in general, as early in the curriculum as possible, and furthermore, it aims to involve employers and other external partners in the educational process as early as possible too. In an agile PBL context, the boundaries between the different spheres of the PBL ecology for learning are necessarily porous; the responsibility for learning concerns everyone involved, rather than just the teachers.

Implementing PBL in a course or program is often challenging enough, and of course, this challenge multiplies when it is a university-wide implementation. It often encounters major obstacles, ranging from professional learning needs to expectations about resource needs. In short, the theory behind PBL is convincing, but the link to practice is not always explicitly made. Therefore, we imagine an agile PBL ecology for learning as empowering a 'way-of-being' in students, opening the possibilities of ubiquitous learning. An agile PBL ecology for learning, leveraging a variety of technologies, provides a way to imagine the knowledge, skills and disposition 'flow' between the different ecosystems within the university environment, but also between the universities and the world outside the universities (macrosystem) more seamlessly. This is crucial if the goal is to develop an agile PBL for a new generation of learners and to make their learning experience as 'authentic' as possible in relation to what they face during their studies or are likely to encounter in the world they will live and work in upon graduation.

## Digital Technologies and the Digital Generation in an Agile PBL Context

A considerable amount of writing has emerged in recent years about the potential of new and emerging technologies for learning (Johnson, Adams Becker, & Hall, 2015). Such writing tends to advocate the use of mobile and social media for their potential affordances ('we will be able to do…' versus 'we have been able to do…') (Rheingold, 2010), but it is often characterised by a lack of empirical evidence to back up the claims. On a theoretical level, mobile and social media technologies appear to fit very closely with social constructivist conceptualisations of teaching and learning, which are widely regarded as most effective and which fit neatly with

PBL. However, despite the apparent momentum in the adoption of mobile and social media in formal (and informal) learning contexts, there is much less clarity about their effectiveness with regard to student learning and outcomes. For example, while we know that many education institutions and individual departments have their own *Facebook* pages, in what way does this contribute to student learning outcomes, and what is the evidence to support this? Engagement is one thing, but tangible learning outcomes is the area we, as educators, really need to focus on before substantial claims about a technology's usefulness can be made.

The key element here is that available technology should be used where relevant and in alignment with the pedagogical approach, rather than the other way around. For example, on a pragmatic level, Pepper (2009, p. 129) identifies the following key benefits of PBL:

- Students deciding on the information and skills they need to investigate issues while building on their current knowledge to synthesise then integrate new information
- Students taking responsibility for the learning that occurs within their group while instructors monitor and facilitate student learning
- Students engaging with the learning experience more fully

In terms of the first point, one of the main benefits of PBL is that it explicitly makes use of students' prior knowledge, thus often successfully manages to engage students, because the learning process starts from 'where they are at' (Brodie & Gibbings, 2007; Tate & Klein-Collins, 2012). This includes the use of online and mobile applications and environments that students are familiar with, especially if they are used in the authentic contexts in which students will engage with problems. The last point in particular is important and related to the other two points, and as Hu (2011) notes, 'student engagement is considered the pathway to success in college'. This engagement is further stimulated by group work, which is another central element of PBL. In relation to group work, and the development of learning communities, social media applications (such as *Facebook* or *Twitter*) can be used to develop such learning communities (Hall & Maugham, 2015; Yeh, 2010). Similarly, multi-user online environments (Omale et al., 2009) and even massive open online courses (MOOCs) (Davies, 2012) can be used, where relevant, for group work and the development of learning communities. There are no hard and fast rules around which tools to use and which not to use, or when and how. As Archetti (2011) argues, 'the effectiveness of PBL as a teaching and learning tool entirely depends on the context of its implementation' or, in other words, its agility to leverage on the complete ecology for learning, rather than isolated pockets of it. Similarly, the development of a technology-supported or 'blended' PBL learning environment should be responsive to where the learners are at and where they should be at the end of a particular unit of study. The latter refers both to how various technologies are relevant in the authentic workplace setting and to how to potentially create the opportunities to address authentic work-based problems. Getting that balance right is fundamental to the success of PBL as a pedagogy and curriculum, and to get that balance right ideally requires a whole-of-institution and a whole-of-cur-

riculum approach, which includes sufficient and just-in-time professional learning for teachers so that they can activate their PBL groups with confidence, for as Savin-Baden (2006, p. 10) has argued, 'PBL online does require that tutors are supported'. This is crucial, especially when students are first engaged with PBL-based learning (and moreover, a blended PBL environment), which is when students often perceive a lack of guidance (Luck & Norton, 2004). As noted above, the teacher's facilitation role is a vital part of PBL, and this is not different in blended, technology-supported forms of PBL, nor is it that far removed from a mentor role in a workplace or business context.

## 'Whole-of-Curriculum' and 'Whole-of-Institution' Approaches

The implementation of successful technology-supported and blended PBL for the next generation of learners requires both a whole-of-curriculum and a whole-of-institution worldview, and by success, we mean that it will achieve the outcomes that are celebrated in the PBL literature and discussed above. This is not an easy task, that is in finding the right blend to what Pascarella and Terenzini (2005) refer to as the *interconnectedness* that are more likely to produce a more effective educational experience. We argue that this is the transformative element of an agile PBL ecology for learning. As noted in the introduction, this is very much a vision and a starting point in this book, rather than a blueprint for implementation, but we believe it is crucial to begin to imagine such a vision.

In short, it needs courage from those in senior management and educational administrative positions at the universities. It requires careful planning of PBL applications across the curriculum, as well as choices about technology to support the desired learning outcomes. Importantly, this is not a one-time process, but rather an ongoing process that is dynamic and adaptive to changing contexts, both internally and externally. Once the curriculum has been mapped or constructively aligned (Biggs & Tang, 2011) according to agile PBL spirit, learning needs of staff should be identified and acted upon and constructively aligned to their 'training' needs to effectively 'teach' in a technology-supported agile PBL context. This is particularly important when it comes to the incorporation of technology-supported applications, because the teachers need to be confidently able to facilitate the development of learning communities in online environments. The IT staff working in the background need to have their professional learning needs met as well, so that they can provide the appropriate support needed, at the appropriate time. Closely related to this is the recruitment of staff. As a learning organisation that is based on a transformative technology-supported agile PBL approach, new staff need to be recruited not simply based on the knowledge they possess, but rather on their willingness to learn and adapt on a continuous basis. In other words, they need to be able to model the same skills and attitudes that we expect students to learn. If the desired outcomes

are students who are lifelong learners, then staff need to model what that means and embody the same principles. Again, this may sound straightforward, but it is far from it in reality.

An agile PBL allows organisations to design adaptive and blended problem-based learning environments that suit their specific student cohorts and their particular contexts. The suite of e-learning tools is potentially endless and ever growing. At the moment, it includes social networking tools (such as *Facebook*, *YouTube* and *Twitter*) that can be integrated into an agile PBL curriculum, along with e-learning tools such as online classrooms, blogs, wikis, multi-user virtual environments (MUVEs) and conferencing technologies. In addition, a series of mobile technologies, such as smart phones and tablets, can be explored for their potential affordances in an agile, blended problem-based learning environment. In each case, decisions need to be made about where and when it is most appropriate, and these decisions hinge, on the one hand, on what students, as the next generation of learners, bring to the learning environments and, on the other hand, on what they should be able to do at that particular stage of the curriculum. Agile PBL problems can thus be designed in such a way that they include both 'comfortable' technologies and 'new' ones in the educational process and indeed 'future' ones.

## Conclusion

Overall, we have made a start in this chapter to imagine what an agile PBL context might look like and how it might suit a new generation of learners, both in terms of what they bring to the learning environment and in terms of the twenty-first-century skills they need to learn. The assumption from the beginning is that with regard to technology-supported PBL, it is not so much a question of *whether* anymore, but rather of *how best to*, and not a question of *whether* it will replace face-to-face PBL, but rather *how best to* blend it with face-to-face PBL, which not coincidently mirrors the 'real world' outside the university. The challenge is how to design a technology-supported agile PBL environment that stays true to the original intentions of PBL and that leverages technology to *enhance* the impact of learning, rather than reducing it. This is the challenge that we are taking up throughout this book. In the next chapter, we will therefore zoom in on the role and place of learning outcomes in an agile PBL ecology for learning.

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