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Research report

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The future of *technology* and learning

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The future of technology and learning

Research report

Contents

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TOWARDS MATURITY

Executive summary

'The rate of technological change is swift, outpacing research and practice. How can learning and development practitioners choose the right technology?'

Technology is a key component of working life, and organisations are taking advantage of the benefits offered by digital tools to enhance their learning and development strategies.

The Towards Maturity Benchmark Study is an internationally recognised longitudinal study on the effective implementation of learning innovation based on the input of 6,000 organisations and 40,000 learners gathered since 2003. All the data provided in this report is taken from Towards Maturity, unless stated otherwise.

Practitioners have clear goals for learning; of the respondents in the Towards Maturity 2016 benchmark survey, 99% wished to improve access to learning, 96% wished to facilitate continuous learning and 94% aimed to improve application of learning to the workplace. The future of learning, then, is set to be continuous and collaborative, taking place anytime, anywhere. With up to a fifth of L&D budget being spent on technology (Towards Maturity 2016), digital tools have a key part to play in achieving this ideal future.

However, the rate of technological change is swift, outpacing research and practice. How can learning and development practitioners choose the right technology to address learner needs and fulfil these strategies while avoiding the hype surrounding new digital tools?

This report analyses the drivers of technology adoption using practitioner data, and evaluates the potential success of emerging technologies against learning design principles and evidence.

The future of learning: critical considerations

Practitioner data suggests that mobile, collaborative and game-based learning are key emerging technologies. Used effectively, these tools have the capability to improve access to learning and enhance knowledge transfer. However, practitioners should be mindful that many technologies advertising themselves as 'game' or 'collaboration' based may not truly reflect learning theory (Roberts 2017, Cheng et al 2014). For example, 80% of practitioners use file-sharing tools, compared with 48% using communities of practice, but file-sharing tools alone are not a learning environment that can foster collaborative or social learning. Communities of practice are better suited to encourage the continuous learning hoped for. **If practitioners wish to use technology as more than an information system, an assessment should be made of the theory behind the tools, identifying if it has the features needed to deliver learning experiences**.

Technology is a relatively new vehicle for learning, but the way that we process information remains the same. Research evidence highlights that the learning process and instructional method of technology is strongly related to positive outcomes, as they are with offline learning (Bernard et al 2004, Sitzmann 2011). **Practitioners should apply what we know about offline transfer of learning to technology,**

identifying digital tools that deliver the ability for practice, feedback and interactivity if they wish to facilitate learning.

Lastly, technology use is likely influenced by the perception that today's learner is self-directed and adept at using digital sources for information-gathering. However, research cautions that self-direction and digital literacy differs between individuals and across contexts, which in turn can affect the uptake of digital content (Bennett and Maton 2010).

In addition, technology alone cannot address barriers such as lack of time to access learning. **Practitioners should be clear on the purpose of technology and implement initiatives that can address learner barriers to achieve success with learning technology**.

Evaluating technology strategies

This report does not suggest that practitioners should avoid new technologies. Instead, we provide a framework based on research evidence through which to evaluate technology and ensure the tools used address real learner challenges and align to business goals. The factors identified are: organisational context, learner needs, purpose of implementation, learning design principles and evidence, and technology trends.

We hope that this report, its recommendations and accompanying framework provide some 'food for thought' on technology and digital learning.

Table 1: Learning technology framework

Factors influencing technology implementation	Checklist
Organisational context • Organisational factors such as culture and business strategy will affect the success of technology. • Practitioners have great knowledge of their own organisations; this should be used to identify barriers to technology effectiveness. • Organisational barriers to offline learning should inform the strategy behind the implementation of technology to address these issues.	☐ What are the barriers to learning in your organisation, as perceived by a variety of stakeholders? How can these be addressed with technology? ☐ Is the organisational context supportive of the technology? Do users have the time and support to both access and contribute to collaborative and user-generated content? ☐ Are there other barriers to the technology being utilised correctly, from security and control issues to learner motivations? If so, what strategy is in place to mitigate these?
Learner needs • Learners have varying levels of digital literacy, and attitudes towards technology use will differ across employees. • Learners can be self-directed, but motivation to learn varies across context and between individuals. • Learners lack time and ability to access learning material; technology can help make information available away from a specific location to allow for better access, but shouldn't be used to promote learning only away from the workplace.	☐ Have any conclusions been drawn about the digital confidence in the organisation? ☐ How have previous technologies been received? If not positive, have the objections been addressed? ☐ Do learners have the time to access content in the working day, and is access to learning encouraged by managers? ☐ Where learning is asynchronous, or requires self-direction, is clear guidance and signposts for assistance available, along with a strategy to manage dropout? ☐ Do users have the correct tools (whether that be mobile devices or traditional computers) to access learning? Do they have the time to do this?

Table 1: continued

Factors influencing technology implementation	Checklist
Purpose of technology • The success of technology implementation will be strongly influenced by how well the characteristics of the tool match the purpose of implementation. • If technology is being implemented for technology's sake, it will not lead to positive outcomes. • File-sharing tools, for example, will not lead to continuous, reflective learning, but they can aid knowledge management and help sharing across locations if implemented correctly and where appropriate.	☐ Is the purpose of the technology project clear, and can the technology truly deliver on these objectives? ☐ If the technology is being used to connect employees or for knowledge management, rather than as a learning environment, has a strategy for measuring ROI been decided? ☐ If the technology is being implemented as a practical way to connect learners or act as a content repository, is learning being prioritised elsewhere? ☐ What other avenues are in place to support the technology, ensuring a blended approach? ☐ How will the technology be supported over time to realise potential long-term benefits?
Learning principles and evidence • The principles of learning remain constant online and offline. • Be cognisant of learning principles such as andragogy[1] and social cognitive theory to evaluate whether the technology can deliver true learning. • Digital learning literature has also highlighted several factors associated with positive learning outcomes, such as interactivity and opportunity for practice. [1] Popularised by Knowles (1980), andragogy refers to adult learning principles such as: self-direction, utilising user knowledge for learning, and tutors facilitating learning rather than instructing. For further information, see page 12 of this report.	☐ Does the technology allow for interactivity, practice, reflection? If not, are there other activities that can be undertaken alongside the technology to allow this? ☐ If the technology is serving current, well-utilised content across domains, does it possess the same features when adapted for online use? ☐ If the technology will be serving current content repurposed for digital use, is the current content well evaluated by learners? If not, how will the technology make the content more engaging? ☐ Does the content served by technology relate to a real-world problem or situation? Is it clear how the learner will use this in their role, or for future development?
Technology trends • Trend reports and vendors provide compelling reasons for implementing new technology, but confusion arises around the definition of new tools such as mobile, collaborative and game-based learning. • Use critical questions to evaluate new technologies and whether they are supported by theory. • Use sources of evidence from education and technology research to identify success factors.	☐ Is the adoption of technology driven by learner needs or technology trends? ☐ Is there evidence for the capability of the technology over and above trend reports? ☐ We know that learning takes place when technology allows interactivity, reflection, and is similar to the real-world environment. Does the new emerging technology have the ability to do this? ☐ Is the technology truly collaborative, or game-based learning, or is it a content repository or motivational tool? If not, is it fit for purpose? ☐ What should be shared with collaborative technology? Have you identified what information you'd like to be shared and do you understand how to measure this?

Introduction

Technology has become an integral part of daily working life; most employees work with machines that are capable of carrying out simple tasks more efficiently, be that automating processes, providing access to information at the click of a button, or connecting people from globally distributed offices to share ideas online in minutes. Indeed, trend analysts (Gartner 2016) suggest that the lines between digital and 'real' worlds will become increasingly blurred in the future, especially with the growing availability of virtual or augmented reality.

Organisations are already taking advantage of the benefits of technology in the workplace by applying it to enable learning and development. The global digital learning industry is a big business – in 2016 alone, investment into the development of digital learning technology reportedly topped $7 billion (Meetari 2017), with emerging technologies such as mobile, simulation and game-based learning set to increase in popularity.

While technology is not set to completely replace 'in person' learning, the majority of organisations are deploying some sort of technology for learning. Practitioners globally reported an average of 18% of their learning budget to be dedicated to technology-enabled learning in 2016, and that 26% of formal learning was technology enabled (Towards Maturity 2016). There has been a decline in formal, off-the-job training (Green et al 2013), and an increase in on-the-job and informal learning. With less time spent in the classroom and less investment in formal learning activities, it is imperative that learning is effective and scalable.

However, a recent CIPD *Employee Outlook* survey (spring 2017) found that 28% of employees reported they had taken part in online learning in the past 12 months, but only 64% rated this useful or very useful. In contrast, 27% of employees reported that they had taken part in on-the-job training, and 92% of these employees agreed on-the-job training was useful or very useful. While learner experience does not give direct insight into the effectiveness of digital learning, the fact that digital learning was less well regarded than other methods suggests that there is a way to go before digital learning meets learner needs.

There is a tension between the pace of change in technology and the stable nature of the fundamental learning process (Tynjälä and Häkkinen 2005). Technology-enabled learning runs the risk of being designed to fit with what technology allows, rather than being driven by learner needs. Tynjälä and Häkkinen caution that *'e-learning is not a miracle remedy to the problems of any work organisation'*, especially if work is organised in a way that is not conducive to learning.

With so many technologies to choose from, practitioners must decide which of these are most effective to support their learning strategies. Yet, as is the case with any emerging technology,

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the evidence base for learning technology use in organisations has not caught up with the pace of practice (Brown and Charlier 2013).

This report

This report aims to stimulate reflection on the use of technology in L&D practice and strategy, providing commentary on recent trends and planned technology usage in a range of global organisations, comparing strategic aims and the needs of learners to the uptake of technology.

Section 1 describes factors that are known to influence technology uptake, such as learner attitudes and skills, technology trends and the push towards 'anytime, anywhere' learning, highlighting the potential pitfalls of making assumptions about learners. We then review the strategic aims of L&D practitioners, and discuss the factors driving the changing expectations of technology.

Section 2 summarises adult learning theories, in order to understand which technologies have the capability to deliver on learning strategies. Next, we analyse research evidence from a variety of studies comparing the effectiveness of online and offline learning, and identify the factors that are associated with successful use of technology for learning.

Section 3 compares technology trends in organisations against evidence and strategy, exploring what drives technology adoption. Collaborative, mobile and game-based learning are highlighted as key emerging technologies, and factors associated with successful use of these tools are discussed.

Finally, the conclusions section provides a summary of the barriers and supporting factors that influence technology update, providing critical questions for practitioners about their future learning strategies and framework through which to appraise technology.

1 Changing learner landscapes and the role of technology

Uptake of learning technology is likely to be influenced by a number of factors, including organisational context (support, cost restrictions), external market (market trends, evidence, remaining competitive, offering similar to peers), and learner needs. This section outlines the trends and learner characteristics influencing technology use in the workplace. These factors are summarised in Table 2.

Learners' digital literacy and attitude towards technology influences uptake

One reported characteristic of the modern learner is the 'digital native' (Prensky 2011). This concept refers to younger generations of learners that have grown up surrounded by and using technology. They expect constant connectivity and use technology and the internet as their first point of call for gathering information – in fact, some researchers believe they may also process it differently (see Prensky 2011, Siemens 2005). This, coupled with the pervasive use of mobile and social networking sites away from the workplace, led some to suggest that technology will be widely accepted as a vehicle for learning.

In contrast, other researchers believe there is little evidence that younger people process information differently, or are automatically adept technology users (Brown and Czerniewicz 2010, Bennett and Maton 2010), instead suggesting that the increase in the use of technology is characteristic of different age groups. Towards Maturity's recent Learner Voice Survey (2016) found that 73% of those aged 41–50 found Google or other web resources most useful for learning, compared with 63% of under-30-year-olds, contrary to the idea that only younger generations always use the internet for information-gathering.

Various factors are associated with learners' ability and willingness to use technology for learning. For example, Bennett and Maton highlighted that amount of experience with technology, rather than age itself, was a more important factor in intentions of individuals from different generations in the UK to use the internet for information-gathering. In a study of young adults in Germany, Zillien and Hargittai (2009) found that socio-economic status was associated with internet use, and also influenced the extent to which individuals used the internet for self-advantage. Finally, digital literacy and learner perceptions of the usefulness of online tools to performance have been linked to increased acceptance of these tools (Mohammadyari and Singh 2015).

Practitioners must appreciate individual differences in digital literacy and acceptance of technology-based learning, as this can influence employees' interaction with the tools. Making clear the benefit of tools and ensuring learners understand how to use technology, regardless of age, is likely to influence the use of digital learning.

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Learners are motivated and self-directed

With one author calling self-directed learning a 'megatrend' almost two decades ago (Straka 1999), it is clear that the idea of the self-directed learner is here to stay. This type of learner knows what they want to learn, is motivated to do so, and regulates their own learning. Learners are increasingly being given control of the pace and content of their learning, which is especially prevalent in digital learning, as learners can stop and start courses and pick and choose their own content.

Allowing learners to set the pace of learning and control their learning environment is a positive trend. However, research suggests that learners do not always make the best use of learning environments (Brown 2001). For example, one study found that providing learners with guidance in complex learner-controlled environments led to more positive outcomes, in part because of increased self-regulation (Bell and Kozlowski 2002).

Shinkareva and Benson (2007) highlighted that the first challenge in any digital learning is that the learner must know how to best utilise technology in self-directed learning, as many online courses are controlled by the learner with little input from a facilitator. This could be especially challenging if a learner lacks confidence with technology.

DeRouin et al (2004) supply a useful framework for self-directed, learner-controlled training, highlighting that providing guidance, understanding that learners have differing needs, and ensuring that organisational climate supports self-directed learning are all important in ensuring self-directed learning is successful. Caution should be taken when assuming that providing self-directed digital learning to be undertaken anywhere, anytime will lead to consistent uptake or completion.

Employees lack time for learning, and technology can address this barrier

Despite technology proposing a location-independent, flexible access to learning, employees still wish to have an appropriate environment to learn in. Issues with accessing content (lack of appropriate devices, or being blocked by a firewall, for example) might also hinder access of content.

In a digital world, we might expect that all staff can access a computer. However, 26% of practitioners have identified insufficient staff access to computers as a barrier to learning (Towards Maturity 2016). Interestingly, this increased from 9% in 2006, even though we would expect in the past ten years computer access would have increased. Especially in industries where an employee does not have a desk or a set piece of computer equipment, providing online learning might fall at the first hurdle as it can't be easily accessed. Lack of IT equipment might also become increasingly an issue, with fewer organisations wishing to provide devices, and more encouraging own-device use.

While practitioners aim to improve volume and accessibility of learning, from a learner employee perspective the biggest barrier to learning is lack of time for self-study (59% in 2016), followed by uninspiring content, lack of study space or IT equipment (Towards Maturity 2016).

Digital learning can be a less time-consuming method, especially when considering the removal of the need to travel to a venue and attend lengthy training sessions at a fixed time. In addition, online content can be accessed 'on the go' (during travel or commuting time, for example) for those who do not have time during their working day to engage with content. Forty per cent of learners reported accessing learning at evenings and weekends (Towards Maturity 2016), suggesting that employees are indeed motivated to learn out of hours at a time that suits them.

However, this does point to the fact that employees are maybe not being allowed enough time to learn during their working day, and the availability of technology to access learning at any time does not solve this fundamental time barrier.

When considering the 'anytime, anywhere' notion of digital learning, it's important to note that constant connectivity is not always a positive. The ability to 'switch off' outside of working hours and recover from daily stressors is important for employee well-being (Sonnentag 2012), and there is a danger that organisations come to expect, or implicitly condone, out-of-hours learning as the norm. In addition, the expectation of out-of-hours learning is especially disadvantageous to those with commitments outside of working hours.

With information on demand and constant connectivity being the new normal, the future of learning looks set to be one where learners can access knowledge and share resources anywhere, supported by the idea that learners are self-directed, adept at using technology, wish to learn anywhere, anytime. However, the assumption that all will be comfortable with technologies and have the ability and motivation to regulate their own learning could hinder learning access rather than help the effectiveness of learning strategies.

Table 2: Learner trends and implications for practitioners

Learner trend	Implications for practitioners
Learners' digital literacy and attitude towards technology influences uptake	Technology is widely used by employees away from the workplace for information-gathering and communication across generations. However, it should not be assumed that all younger people are 'digital natives', or that digital learning will be effective simply because of the abundance of technology use outside the workplace. Learners may use technology in their personal lives, but not yet perceive technology to be useful for workplace learning. Practitioners should ensure they evaluate the digital confidence in their organisation and ensure guidance is provided for those using digital tools.
Learners are motivated and self-directed	Technology that allows more self-direction and learner control is a positive way to engage employees in learning. Practitioners should be aware, however, that an individual's ability or motivation to be self-directed may differ across contexts. To combat this, practitioners must ensure that users understand the technology and how best to utilise its features, as digital literacy, preference for online technology, and self-directedness vary between learner and content. Learners may benefit from some level of structure and guidance. Moreover, the content itself must be useful and perceived well by employees.
Employees lack time for learning, and technology can address this barrier	Practitioners should ensure that technology is not implemented in a vacuum. Digital tools can allow increased access to information; however, the act of providing access does not necessarily lead to learning. Complementary initiatives may be needed to address the issue of lack of time or low learner motivation in order for digital learning to be a success. In addition, organisations will need to ensure there is adequate time to learn in working hours. Without this, there is a danger that it will become necessary for learners to access content outside of the workplace.

What are current practitioner expectations of technology?

This section explores practitioner aims for technology, using data on practitioner strategy.

The Towards Maturity benchmark survey collects insights from over 600 organisations on a yearly basis, providing an annual snapshot of the learning and development landscape. Practitioners identify their technology usage and aims for their modernised learning strategy. Table 3 describes the goals that practitioners aimed to achieve and have achieved with their overall learning strategies, and social and mobile learning in 2016 (n=537).

Table 3: Aims for learning strategy and technology use (%)

Aim	2012	2016	% change	2012	2016	% change
Overall strategic aims						
	Wish to achieve			**Have achieved**		
Increase access and flexibility in providing staff training	98	99	+1	40	43	+3
Increase volume of learning – reaching more people	91	93	+2	39	38	-1
Extend learning to remote workers	*	86	*	*	35	*
Facilitate new ways of working	*	78	*	*	25	*
Provide a faster response to changing business conditions	92	95	+3	27	19	–8
Push updated information to employees at the point of need	*	93	*	*	23	*
Integrate learning into the workflow	*	93	*	*	15	*
Aims of mobile and social/collaborative learning						
	Wish to achieve			**Have achieved**		
Improve application of learning back in the workplace	44	94	+50	20	17	–3
Improve support for personal professional development	49	93	+44	16 (2013)	24	+8
Encourage reflection (for example by narrating learning journey)	43	92	+49	9 (2013)	9	0
Build networks inside the organisation	68	91	+23	25 (2013)	26	+1
Improve generation and sharing of user-generated content	55	88	+33	15	9	–6
Develop networks outside the organisation	42	77	+35	19 (2013)	19	0
Promote organised training initiatives	38	93	+55	22 (2013)	33	+11
Allow individuals to message/communicate in real time	54	84	+30	32	27	–5
Facilitate continuous learning	56 (2014)	96	+40	*	13	*
Improve access to support at the point of need	66	92	+26	20	17	–3
Improve communication between learners and tutors	63	85	+22	18	14	–4
All learners to use their own mobile devices	59	85	+26	21	24	+3
Improve communication between individuals	69	21 (2015)	–48	24	*	*
Reduce cost of IT support/delivery	53	17 (2015)	–36	16	*	*

Practitioners have high expectations of technology; over three-quarters of respondents wish to achieve strategic aims with mobile and social tools. The perception that these tools are able to deliver on these aims is likely influenced by learner trends. The trend of the motivated, self-directed learner who is digitally literate and looks to technology for information also seems to have influenced practitioners' belief in the efficacy of technology.

Over 90% of practitioners aim to facilitate reflection and continuous learning with mobile and social tools, highlighting that these technologies are perceived to be effective learning environments. Other perceived benefits of these technologies include improving application of learning back in the workplace (94%), a 50% rise since 2012.

However, just 17% of practitioners feel they have improved application of learning in the workplace, compared with the 94% wishing to do this. Achievement of this goal has marginally decreased since 2012. Similarly, only 9% feel they have encouraged reflection, which remains unchanged from 2013. The gap between what has been achieved with technology, and what practitioners hope to achieve, highlights that digital learning is not yet being used in the most effective way, or at the least, barriers to effectiveness (such as IT issues, or security risks) have not been removed.

Access to learning is also a key concern for practitioners, with lack of time for learning cited as a barrier to learning by employees. Technology is being used to address this issue: 99% of practitioners want to achieve flexibility and improved access to learning content, and 93% wish to increase the volume to reach more learners. There is a clear gap between aims and achievement in this area: 43% of practitioners in 2016 felt they had achieved greater flexibility and access to learning within their organisations, compared with the 99% of practitioners hoping for this benefit.

Some aims have become less central to learning strategies. In 2012, improving communication between individuals and reducing cost of IT support/delivery were reported as key goals, with 55% and 43% wishing to achieve these benefits. Now less than a quarter of practitioners wish to achieve these aims. This suggests that the aim for mobile and social tools have become less operational, and more focused on improving learning outcomes.

Summary

Our review of practitioners' expectations of technology in learning reveals that the majority are looking to facilitate responsive, reflective learning opportunities, as well as supporting employees at the point of need in a flexible, scalable manner. Technology will be just one tool to deliver on these strategies, but given that organisations are spending up to a third of their L&D budget on technology, it is fair to say this will play a significant part in fulfilling these practical and strategic aims. However, there remains a large gap between aims and achievement.

The next section reviews the learning theories that could underpin decision-making about implementation and utilisation of technology in learning.

2 What do we know about effective learning technologies?

'In order to understand which technological tools will be successful, we must understand the process of learning.'

In order to understand which technological tools will be successful, we must understand the process of learning. This section unpacks the theoretical constructs underpinning this and analyses the conditions that lead to effective learning, both online and offline, using research evidence.

Principles of learning

Some practitioners argue that technology will fundamentally alter how we learn (Siemens 2005). Others challenge this, saying the process by which learning occurs remains the same (Tynjälä and Häkkinen 2005). It might be most accurate to say that while the mechanisms by which we receive or search for information are changing, the way we learn from that information remains the same. Meta-analyses conducted to examine the difference in success between offline and online learning methods support this idea, finding that similar instructional methods lead to the same learning outcomes regardless of delivery channel (Sitzmann 2006).

There are several theories or frameworks that outline the principles of how people learn. One popular term is pedagogy, referring to the principles of how children learn. This is typically a concept that is used in traditional classroom settings, but is also erroneously referred to in management research that is concerned with the development of adults (Forrest and Peterson 2006).

An influential philosophy of adult learning is **andragogy**. Knowles (1980) resurfaced this idea, differentiating the needs of adult learners from those of children. Andragogic principles suggest that adults are autonomous, self-directed, motivated, problem- or goal-oriented, and have rich experience on which to draw from. This is closely linked with self-directed learning, which has been a popular concept in literature for many years (Knowles 1975). This broad concept generally refers to the ability of adults to understand what they need to learn and to motivate themselves to do so. Practitioners are also applying this concept to their organisations, designing learning that can be controlled by the user. This is not to say that there should be no guidance in adult learning, but that tutors should facilitate rather than instruct.

Heutagogy centres on the concept of self-determined learning, and is a recent extension to andragogy (Hase and Kenyon 2000). This concept highlights the importance of self-efficacy and individuals not only taking part in learning activities to increase competencies, but developing the capability to learn itself. Finally, heutagogy suggests that the individual (as opposed to instructors) should select what they need to learn, signalling a complete shift from traditional classroom teaching. This concept has been applied in distance education, allowing students to decide their course content and their assessment method (Blaschke 2012).

It should be acknowledged that individual knowledge and ability to be self-directed will vary between contexts (for example, learning an entirely new skill at work will require a different type of instruction from an action learning discussion between experts), and self-directed learning can vary between situations and individuals, as discussed in previous sections.

Digital learning, then, should allow interaction and facilitation by a tutor where possible, allow users to draw upon their own experiences, and be oriented towards a specific goal that is relevant to the learning context. As with any type of learning activity, digital tools should allow for interactivity and reflection using blended learning where possible. And, if learner collaboration is the chosen learning method, people practitioners should provide guidance and support throughout the learning process and in the design of the digital learning environment.

The process of learning

Andragogy provides a useful philosophy to take into account when designing adult learning experiences, but does not unpack the process by which learning occurs. These processes have been described through a number of lenses, which are best thought of as complementary rather than competing theories (Johnson and Aragon 2003).

Cognitive learning theories (Anderson 1982) are concerned with the internal mental processes through which learning occurs and information is stored and retrieved (through critical appraisals, schemas and heuristics).

Socio-cultural theory (Lave 1993) suggests that individuals learn through observation, modelling others' behaviour, and will be motivated to transfer and use this knowledge through social reinforcement and self-efficacy. The wider social and cultural context in which learning occurs is essential for learning to take place. This idea is mirrored by social constructivist theory (Vygotsky 1978), which highlights the importance of the nature of collaboration in learning, with learning occurring through individual interactions with the wider social context. Instead of traditional instructional methods, this theory suggests that individuals construct knowledge through their interaction with others.

Both social and cognitive theories agree on the premise that knowledge is constructed through problem-solving (going further than repetition of new knowledge) and this action of problem-solving using acquired knowledge is synonymous with transfer of learning. Both theories are also linked to the concept of **situated learning**, where learners are oriented towards solving a problem within a context similar to one where the knowledge will be applied (Billett 1996). For knowledge to be robust, it needs to be applicable across context, but the further the transfer, the less likely it is to happen.

In addition, Johnson and Aragon (2003) suggest that digital learning needs to allow social interaction and 'real-life' activities, to address student motivations and individual differences, and to allow opportunity to reinforce their learning in their communities. These theories provide an important call to action for those designing any type of learning experience to allow learners to apply their new knowledge to problems, and to ensure that technology mediums

'As with any type of learning activity, digital tools should allow for interactivity and reflection using blended learning where possible.'

'It is clear that a "one size fits all" design will not ensure good outcomes in technology-enabled learning, as each type of learning experience has different characteristics.'

allow this sort of learning, or provide offline experiences that are complementary to the digital initiative.

Taking in information is a prerequisite for learning, but learning theory posits that in order for learning to truly occur, the information must be used across situations in response to a problem or goal. This learning can be reinforced through a variety of mediums, whether this be opportunity to practise new skills, or use the new learnings to solve problems in different contexts, bringing together theoretical and practical knowledge.

These theories provide a useful framework by which to evaluate the potential effectiveness of learning initiatives. In addition to theoretical frameworks, there is a wide variety of research into digital learning effectiveness that should influence technology uptake in organisations.

Evidence on the effectiveness of technology-enabled learning

While systematic, controlled research into the effectiveness of emerging learning technology in a workplace setting is not widely available, technology use in traditional and distance education has been researched for decades, as has offline transfer of learning.

While adult education and distance learning are not identical settings to the workplace, parallels between distance education and digital learning in organisations are strong. Distance learning is often asynchronous, with students accessing material at different times, with a low amount of (if any) face-to-face time. In addition, distance education must make use of technology and has a largely adult population. Several studies have compared the effectiveness of different learning delivery methods, and have found that blended learning is preferable for delivery, and that classroom and online methods do not differ widely in their effectiveness when certain conditions are met (see, for example, Bernard et al 2004).

It is clear that a 'one size fits all' design will not ensure good outcomes in technology-enabled learning, as each type of learning experience has different characteristics; it might be delivered asynchronously, have different instructional methods, or different levels of interaction with other students or tutors, all of which impact on learning outcomes.

For digital learning specifically, scholars have identified several moderating factors influencing the relationship between learning delivery method and positive outcomes. These included type of knowledge acquired, human interaction, practice and feedback, and length of activity, all of which moderated the relationship between type of delivery method and learning outcomes. For web-based learning in particular, the opportunity for feedback and practice enhanced the effectiveness of the learning. A key finding is that instructional method, interactivity and opportunity for practice are key facets of digital learning or distance learning that lead to positive learning outcomes (Sitzmann et al 2006).

These findings shine a light on the fact that the design of learning, rather than the vehicle in which it is delivered, is imperative for effective learning. Digital learning does not possess any 'special' characteristics for learning, although delivery might be more accessible.

None of the factors identified in these studies could fully explain the variation in learning outcomes.

Other organisational factors will undoubtedly influence the outcomes of learning, such as organisational support and culture.

Emerging technology evidence

While the majority of current studies on the use of technology in learning are concerned with traditional learning tools, such as digital learning courses, practitioners are increasingly looking to utilise novel tools such as mobile, social and game-based learning to achieve their strategic aims.

Mobile, social and game-based learning do not have a clear definition and are referred to in a variety of contexts. Table 4 outlines some of the definitions of each tool.

Mobile learning tools

Mobile learning is thought to be effective because it enhances collaboration and social interaction in many locations, provides situated learning opportunities where information can be applied in the right context, and gives learners a choice of how and when they access learning.

In a review of the relationship between learning via mobile devices and student outcomes, Sung et al (2016) found a medium effect size for mobile learning being more effective than pen- or paper-based learning. In addition, informal environments (such as learning in a museum context) contributed to greater effectiveness, compared with using mobile devices in a classroom or traditional learning setting. Teaching method was also identified as a contributing factor, with collaborative and inquiry-based mobile methods having the largest effect on outcomes. These results suggest that collaboration or problem-based methods are more effective ways in which to use this technology, and that mobile devices can be especially helpful in informal contexts to support learning, where access to learning tools might not be available without a mobile device.

Karimi (2016) explored the personal characteristics that might influence adoption of mobile technology by learners. They found that students' innovativeness

Table 4: Definitions of emerging technology trends

Emerging technology	Definition
Mobile learning tools	Mobile devices are seen as a way to deliver learning at the point of need, to those travelling or working away from a fixed location (Saccol et al 2010). Mobile learning can refer to learning on a number of devices, not just smartphones; learning delivered through a laptop, tablet, or personal digital assistant are also considered in mobile learning literature. It can also refer simply to the overall mobility of learning not being tied to a particular location or type of device (Traxler 2007, Park 2011).
Collaborative learning tools	Technology is branded as a collaborative learning tool where it facilitates any sort of interaction between learners. This term is used in the context of social networks, knowledge-sharing, communities of practice (both offline and online), amongst other tools such as messenger systems and online meeting tools. However, true collaborative learning will occur in an environment that allows the process of social learning to occur. This refers to knowledge acquisition and transfer that occurs through a social environment.
Game-based learning tools	As with collaborative learning, gamification and game-based learning cover several related but different concepts. For example, game-based learning can describe the use of elements of games (such as game-based instructions or leaderboards), but can also include immersive learning environments and serious games. A 'serious game' in an L&D context refers to a game with a purpose. For example, military training may rely on games where a person can 'win' or 'lose', just like in a real-world environment. Gamification refers to initiatives where the rules of games are applied to a situation – for example, introducing leaderboards into a learning environment.

influenced their intended adoption of mobile learning. When students perceived that using the technology would impact on their performance, their intention to use technology also increased. Practitioners should ensure that guidance and facilitation, particularly for those who are less confident in using technology, is available alongside the provision of mobile-accessible content.

These studies left unanswered the question of how exactly mobile learning becomes a useful learning tool: is it merely a more flexible vehicle for delivery of learning, or does it have additional value? In order to positively impact on learning outcomes, *'researchers must find the key to integrating mobile devices with instructional strategies and ingeniously match the unique features of mobile devices to the resolution of specific pedagogic challenges'* (Sung et al 2016). When mobile technology adds interactivity to informal learning or in environments where collaboration is usually difficult, this tool can add value.

Collaborative learning tools

Workplace learning is often informal and hard to quantify – the outcome of interaction with others and new challenges (Eraut 1994). This might be hard to replicate online, but Breunig (2016) highlights that there is no reason to believe this sort of learning cannot happen online, although this sort of learning requires some strategy and structure to enable true collaboration (Häkkinen et al 2003).

Online communities of practice (COP) represent one structured way of collaborating, a concept developed in line with social learning theory (Lave and Wenger 1991). Communities of practice within organisational contexts provide more opportunity for in-depth conversation, feedback and reflection with a group of employees for development purposes. For COPs to be effective, they must be supported by line managers providing learners with time and access to learn, and a safe space to share ideas and concerns (Barbara and Dina 2006).

Sharing of knowledge (whether through an online information management system, or social network) often falls under the net of collaborative learning in organisations through virtual communities (Cheng et al 2014), even though in itself it does not constitute learning. Reflection, practice and interactivity are important for learning to occur. If the knowledge management and sharing system does not encourage these processes, it risks being a costly but ineffective intervention (Wang et al 2007). Practitioners must first understand the impact of learning design in relation to what they want to achieve, and second, use technology to support this.

Game-based learning tools

There is comparatively little evidence available on the effectiveness of game-based learning in organisations. One review (Sitzmann 2011) suggested that computer-based simulation games contributed to greater learner outcomes than non-game methods. However, as is the case with any type of online learning, technology itself was not the largest influence of effectiveness: instead, it is the quality and characteristics of the learning – specifically the availability of interactive instructions – that were important.

Truly immersive game experiences can be an effective method for learning, especially in high-risk, high-cost scenarios, but game-based elements such as leaderboards are not synonymous with immersive game-based learning. Using only elements of games may dilute the effectiveness of these tools.

Summary

Research suggests that the factors that influence positive outcomes with emerging tools are similar to those of traditional tools, namely that instructional method, organisational context, and learner needs will influence success.[2] The consistency of these findings supports the idea that the learning process is stable across contexts of offline and online learning. Table 5 summarises the implications of the learning theories and evidence reviewed in this chapter.

2 For further detail on the studies outlined in this section and additional evidence, refer to the Appendix.

Table 5: Learning theories and evidence: implications for practitioners

		Implications for practice
Learning principles and evidence	**Social learning and social constructivist learning** (Lave 1993, Vygotsky 1978) Learning takes place through observation, modelling and motivation to transfer learning through social reinforcement. The wider social and cultural context in which learning occurs is essential for learning to take place.	The environment should support learning by providing opportunity to practise as well as incentivising practice. Social reinforcement, through social norms and role-modelling, is important for training transfer. Individuals can construct knowledge through collaboration with others. Create opportunity for collaboration, towards a common goal, in order to facilitate social learning.
	Cognitive learning (Anderson 1982) Learning takes place through several mental processes, being consolidated through storage and retrieval, and activating prior knowledge. Different types of information may be learned and accessed differently.	Information given during learning must be integrated into practice. For consolidation to happen, interactivity and practice are therefore important. Activating prior knowledge in response to issues, collaborating with others, and reflection allow consolidation of knowledge, leading to robust learning.
	Situated learning (Billett 1996) Learners are oriented towards solving a problem within a context similar to one where the knowledge will be applied.	Learning that is problem-oriented and takes place in a similar context to which it will be applied is more likely to be successful. The knowledge needs to be applicable across contexts, but the further the transfer, the less likely it is to happen. Make clear the link between the digital learning and real-life context.
	Andragogic and heutagogic principles (Knowles 1980, Hase and Kenyon 2000)	Instructors should facilitate where possible, unless a completely new skill is being learned, and remember to draw upon the experience of individuals to shape learning objectives (or allow the learner to completely design their own learning). Adult learners, when motivated to learn, can be self-regulated and understand their own learning needs. Ensure learning appeals to the motivations of employees. Facilitating double-loop learning through activities such as communities of practice and action learning allow for such self-direction.
	Digital learning evidence	Instructional method, interactivity and opportunity for practice are key facets of digital learning or distance learning that lead to positive learning outcomes. The moderators noted above directly reflect what we know about the process of learning – that interaction and practice are key to consolidate knowledge into practice. Practitioners should be aware that learner preferences for web- or classroom-based instruction may affect learning outcomes; employees may evaluate digital learning less favourably depending on their preference for technology.

Table 5: continued

		Implications for practice
Technology trends	**Mobile learning tools**	Collaboration or problem-based methods are more effective ways in which to use mobile, and mobile can be especially helpful in an informal context to support learning, where access to learning tools might not be available without mobile.
	Collaborative learning tools	Learning can happen 'by doing' or participating, with no reason to believe that this cannot happen online. Challenges faced by offline social networks and communities of practice (such as time, and lack of participation) will pervade online versions of these tools; if time is already a barrier, allowing users to access communities from home will not solve the issue. If communities of practice lack reciprocity and learners lack security to share ideas, collaboration will not occur.
	Game-based learning tools	Technology itself is not the largest influence on learning effectiveness: instead, it is the quality and characteristics of the environment – specifically the availability of interactive instructions – that are important. Immersive game experiences can be an effective method for learning, especially in high-risk, high-cost scenarios, but game-based elements such as leaderboards are not synonymous with game-based learning.
Other factors	**Organisational context**	The organisational context will influence the outcomes of learning; instructional design alone cannot account for the variance in digital learning success. Manager support for learning initiatives and organisational support for time to learn are important in ensuring collaboration can take place and learning can be accessed.

3 How strategic is the uptake of emerging technologies?

The previous section highlighted the need for practitioners to ensure that basic learning principles are met in digital learning design if they wish to use technology as a facilitator of learning. This section uncovers what technology is being used in organisations, and discusses whether the tools used are responding to learning strategies and needs, or other factors.

As discussed in section 1, some of the key strategic aims of L&D practitioners are to improve access to learning, push information to employees at the point of need, respond to changing business conditions, facilitate new ways of working and promote continuous learning. To fulfil these goals, practitioners should select tools that allow easy, flexible access to content, can be developed quickly, promote reflection and encourage learners to share their knowledge with others.

Trends in digital learning

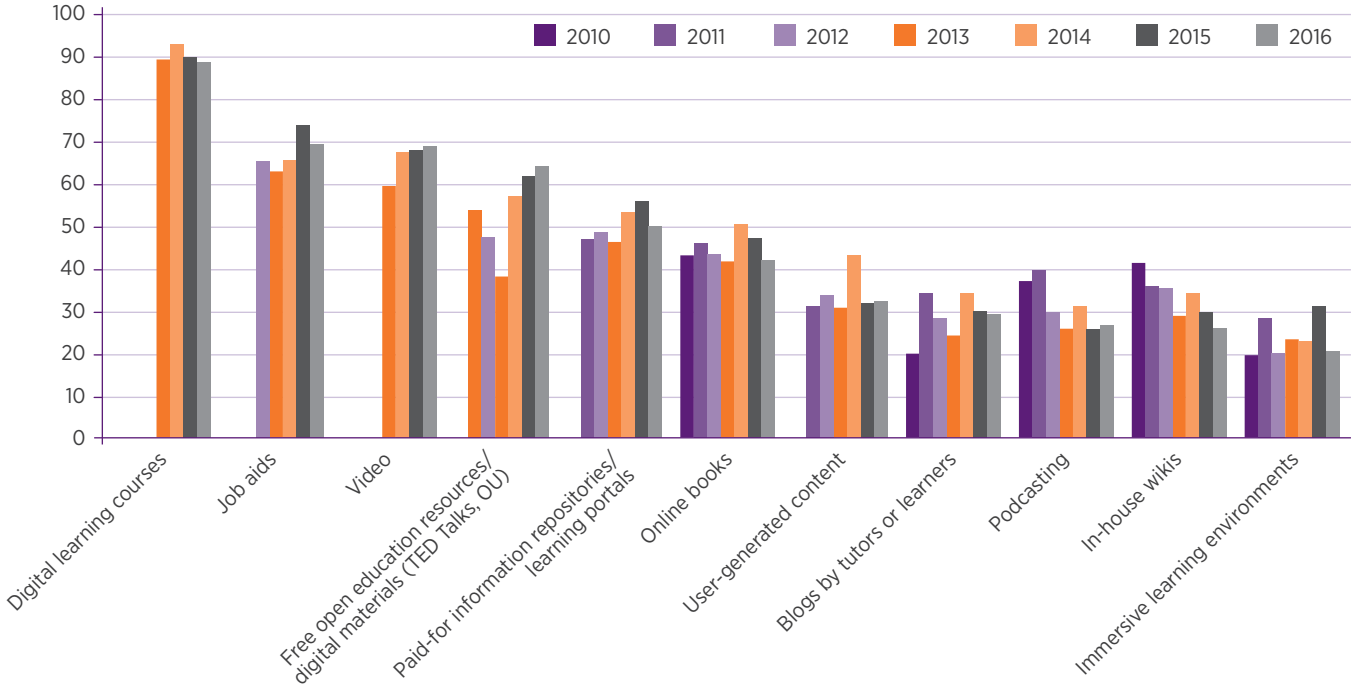
In the Towards Maturity survey, practitioners were asked to select technologies used (or being tested for use) to support content delivery. In addition, they selected the technologies planned for implementation in the next two years, giving an insight into what tools will be used to support strategy in the future.

Historical data illustrates that tools can fall out of favour over time; in 2010 the most popular tool was online books (43% using this), followed by in-house wikis (41%) and podcasting (37%). In-house wikis and podcasts in particular have declined in use between 2010 and 2016 (15% and 10% decline respectively), despite the declared aim of practitioners to share user-generated content.

An alternative allowing practitioners to respond quickly to business need could be 'light touch' methods, such as open education resources that require no development time or budget. In fact, TED Talks and open higher education courses have seen a 25% increase in use between 2013 and 2016, after a 10% decrease between 2010 and 2013. This may be in part due to the availability of open resources, with TED Talks reaching 500 million views in 2011, and several American universities now offering free online versions of their courses. The belief that learners are digitally literate and use the internet as their first point of call for information could also influence this uptake.

It is easy to see why these cost-neutral, popular tools are being used in organisations. However, their capacity to enable learning

Figure 1: Digital learning tool use, 2010–16 (%)



will depend on the features of the open resources. Freely available university courses, for example, are different in format from TED Talks. The latter provides short bursts of information that, taken alone, may not be transferred back into the workplace. Other open education resources such as online university courses might be more interactive or offer discussion opportunities that are linked with learning.

Focusing on these new open-resource technologies, and not focusing on promoting internal knowledge, risks pointing employees to information that isn't directly applicable to the workplace unless it is curated by practitioners. Context-relevance is key for learning transfer (Billett 1996), and many open-resource technologies do not encourage users to share their knowledge and reflect on what they have learned, unless scaffolding techniques are used to create context. In the longer term, this will not help practitioners to facilitate continuous learning and improve application of learning back into the workplace. Cost savings and time savings might be driving this trend, at the expense of strategic goals.

Do technology trends influence technology uptake?

The widespread adoption of new open resources such as TED Talks suggests that practitioners are not afraid to use new technology. In fact, some evidence suggests that emergence of new technology and its uptake by early adopters can in itself drive its increasing use. While new tools emerge on a regular basis, often with promises of big results, trend reports in the technology and learning sector lacked objectivity or quality methodology on which claims were based (Boon et al 2005). As a result, the reports themselves can often 'set the trend', encouraging adoption of technology.

In addition, some have suggested that when new technologies are available, we tend to overestimate the capabilities and successes of them, and underestimate the long-term impact. This concept, referred to as Amara's law (*PC Magazine* 2012), outlines that initial interest and publicity leads to quick adoption, and when technology fails to deliver on its promises, adoption wanes. With competition for talent fierce, and organisations under pressure to constantly learn and evolve to stay competitive, practitioners may often look for novel ways to stay ahead of the curve and readily implement new technologies.

The Towards Maturity benchmark survey confirms that as technologies are introduced, there is an increase in adoption. For example, while Dropbox has been available since 2008 for file-sharing, in 2010 only 22% of practitioners reported using this tool. A year after the release of Google Drive, 30% were utilising this technology, rising to 49% the following year.

With visible brands releasing technology that supports a certain type of learning, and trend reports predicting uptake of tools, it may not be clear if technology is implemented because it has become available (or a more advanced version of existing technology has been launched), or technology has become available in response to market need. Further research should be undertaken to better understand this relationship.

Table 6: Technology release dates and uptake (%)

Technology	Launch date	Usage year before	Usage year following release	Planned usage a year after release
iPad (mobile devices)	2012	39	53 (2015)	79 (2015)
Slack (internal social network)	2013	29	44	50
Google Drive (file sharing software)	2012	20	30	49
Google Hangouts (VOIP conference)	2013	43	54	60
Facebook for work (internal social network)	2016	44	52	n/a
Skype for Business (online meetings)	2015	54	60	n/a

Of course, technology cannot be implemented until it is launched, and new products should not be ignored if they can address business issues. However, practitioners should ensure technology adoption is being driven by learner and business needs, rather than by product availability, to ensure the technology implemented supports strategy.

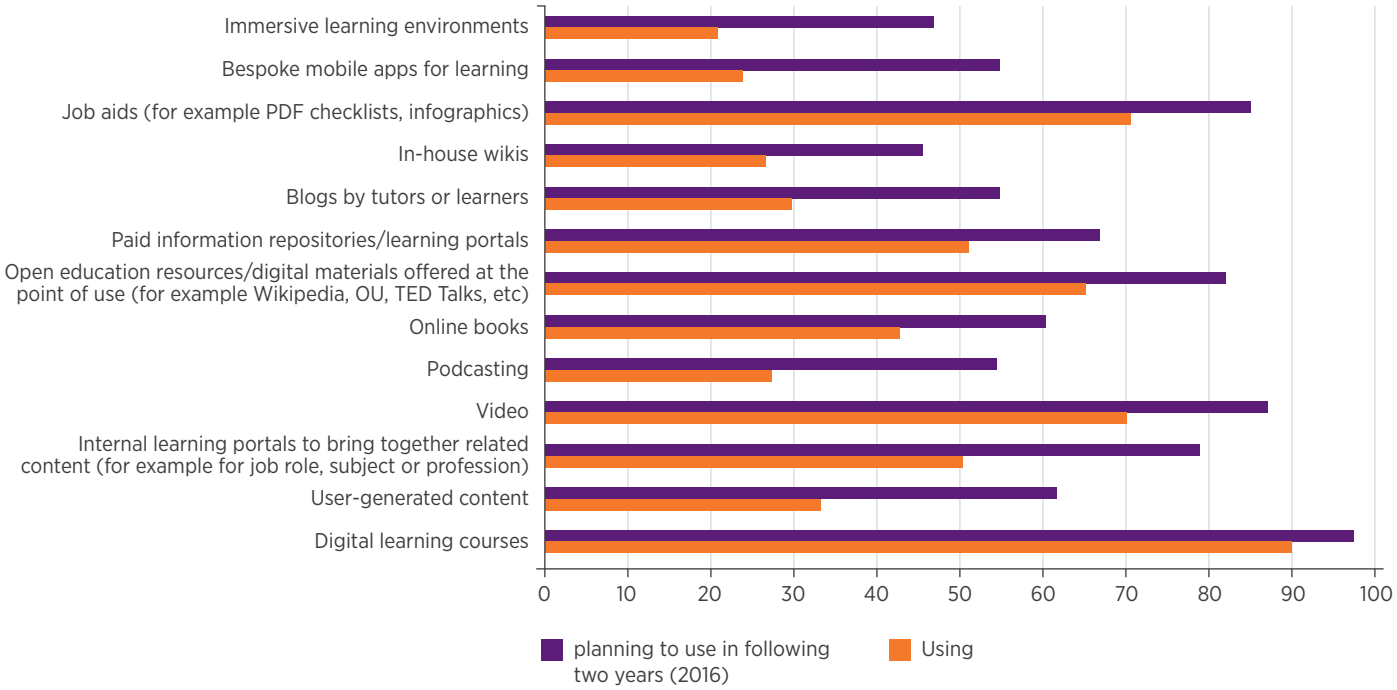
Which technologies are set to emerge as a key part of strategy?

The most popular technology used in organisations is digital learning courses, used by 88%. Their popularity has been constant over time, relatively unaffected by the introduction of new technologies. This trend is not surprising, as online courses provide flexible access to learning at volume, a key concern for practitioners. However, with a reported gap between strategy aims and achievement, and new technologies continuously being launched, practitioners will look to other tools to supplement digital learning courses and achieve other goals.

Online learning courses will continue to be popular, but other emerging technologies are set to be increasingly used to support strategy. In particular, game-based, mobile and collaborative learning are widely planned for use. For example, use of bespoke mobile apps is set to rise by 30% in the next two years, intention to use blogs (just one aspect of collaborative learning) is reportedly set to increase by 25%, and 54% plan to use immersive learning environments such as serious games.

High expectations for technology to achieve strategic aims (such as promoting continuous learning and reflection) is mirrored in the increased intention to these tools. Research shows that mobile, collaborative and game-based technologies can be effective in promoting positive learning outcomes when certain conditions are met. Do practitioner plans for implementation match these conditions?

Figure 2: Digital learning tools use in 2016 in comparison with planned usage in 2016 (%)



'High expectations for technology to achieve strategic aims (such as promoting continuous learning and reflection) is mirrored in the increased intention to use these tools.'

Spotlight on game-based learning

The use of achievement goals and badges has increased by 11% since 2013, with 39% of practitioners reporting use of this tool in 2016. Immersive learning environments (such as serious games and simulations) are used by 20%, showing little change since 2010 (19% using).

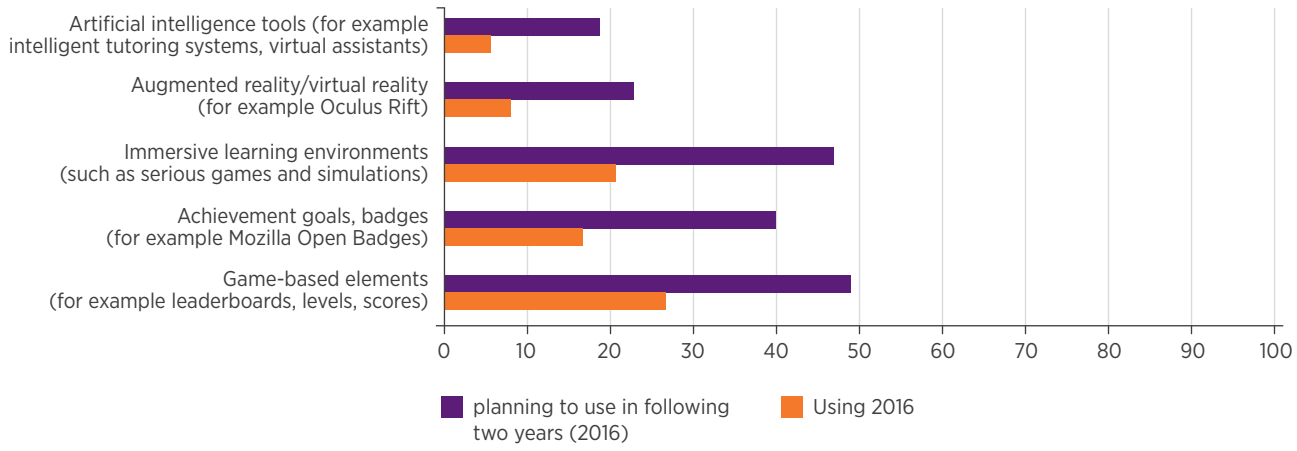
As implementation of these tools is fairly consistent over time, it is likely be the case that these tools are only relevant in certain workplaces, for example where learning in 'real life' is high risk and high cost in sectors such as healthcare and construction, and many organisations might not feel they are worth the investment. However, serious games might not be appropriate for all types of learning, and require resource to develop and implement, and so discrete game-based elements of learning remain more popular, with leaderboards used by 26%.

Immersive learning environments allow learning to directly reflect the context in which it should be applied. The interactivity of immersive games, especially those that bring together employees, can also reflect the 'real world' collaboration environment. As has been highlighted as one of the factors associated with effective game-based learning (Sitzmann 2011), it is important that immersive experiences are well designed in order for them to be more effective than other types of learning.

With the popularity of games set to increase, there is a risk that games will be distilled into their component parts, such as leaderboards and badges, in order for practitioners to easily tap into this trend. In the next two years, the use of these game-based elements looks set to increase, with 48% planning to use these tools, compared with the 26% of practitioners using them now. Use of achievement goals is also set to increase in use.

These are relatively superficial parts of game-based learning; it is unlikely that the tools will yield the same results as immersive games and simulations. They should be used as part of a wider strategy, rather than being used as the sole motivator for learning in order to be successful (Roberts 2017). The true value of game-based or simulation-based learning will be found when participants are required to fully engage their emotional and cognitive faculties as they would in the workplace,

Figure 3: Game-based and immersive tool use in 2016 in comparison with planned usage in 2016 (%)



allowing self-efficacy and increased transfer within the 'real life' context.

The least widely used are AI (artificial intelligence) tools, perhaps not surprising given that these tools have only recently come to the commercial market. Augmented reality is also used by only 8% of organisations. Both of these look set to increase in usage (19% planning to use augmented reality, and 22% planning to use AI tools in the next two years); however, it is not clear whether their increasing popularity is dictated by novelty or effectiveness.

Spotlight on collaborative learning

The use of internal information systems for collaboration has been apparent since 2010, with 52% of practitioners reporting using these, with an increase of 21% in use over time. File-sharing software use has also risen by 48% since 2010.

Information systems look to remain popular, with 80% of practitioners planning to use them. However, knowledge management is not synonymous with learning. If these technologies are embedded as part of wider practices for learning, their use can be effective. These tools alone, however, will not promote the collaboration that will lead to application of learning into the workplace and continuous learning that practitioners wish to achieve with collaborative learning. However, more practitioners report use of file-sharing tools than initiatives such as communities of practice. These information systems may have been prioritised as part of wider organisational strategies for knowledge management.

'Research shows that mobile, collaborative and game-based technologies can be effective in promoting positive learning outcomes when certain conditions are met.'

Figure 4: Collaborative learning tool usage, 2012–16 (%)

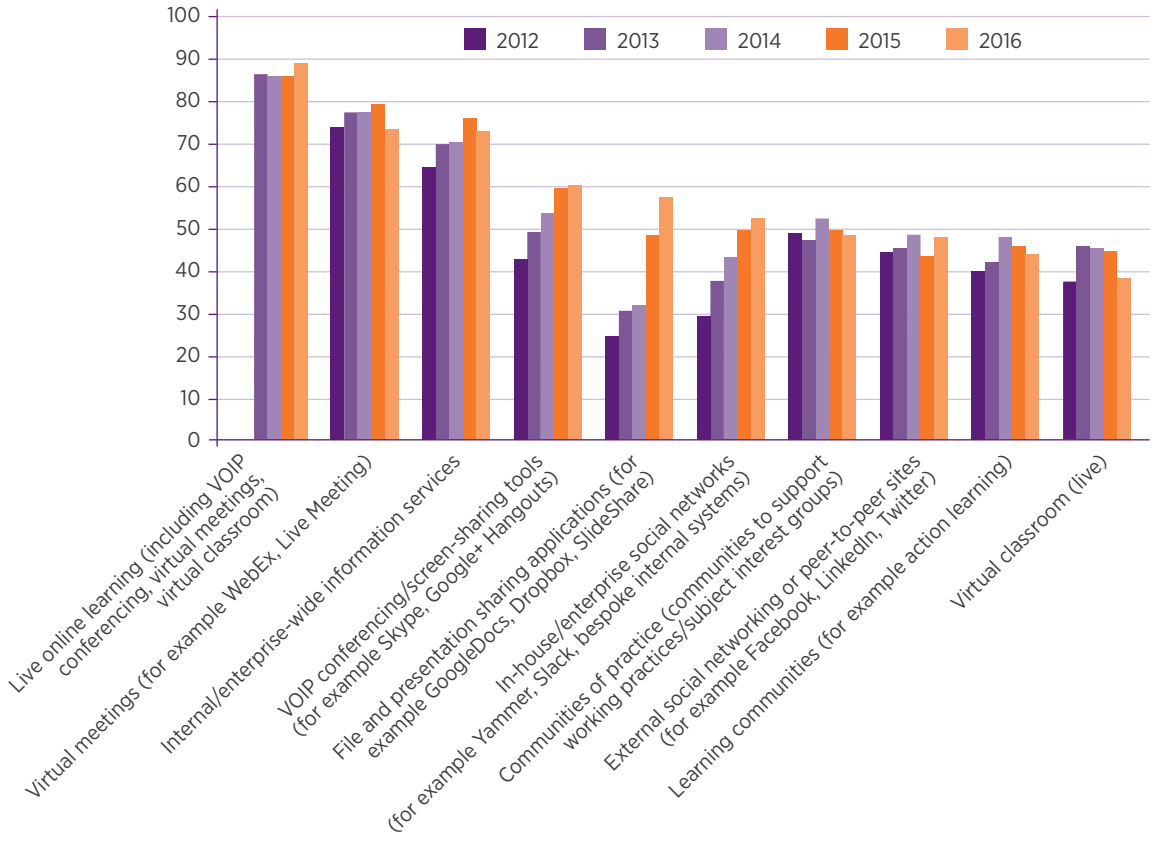
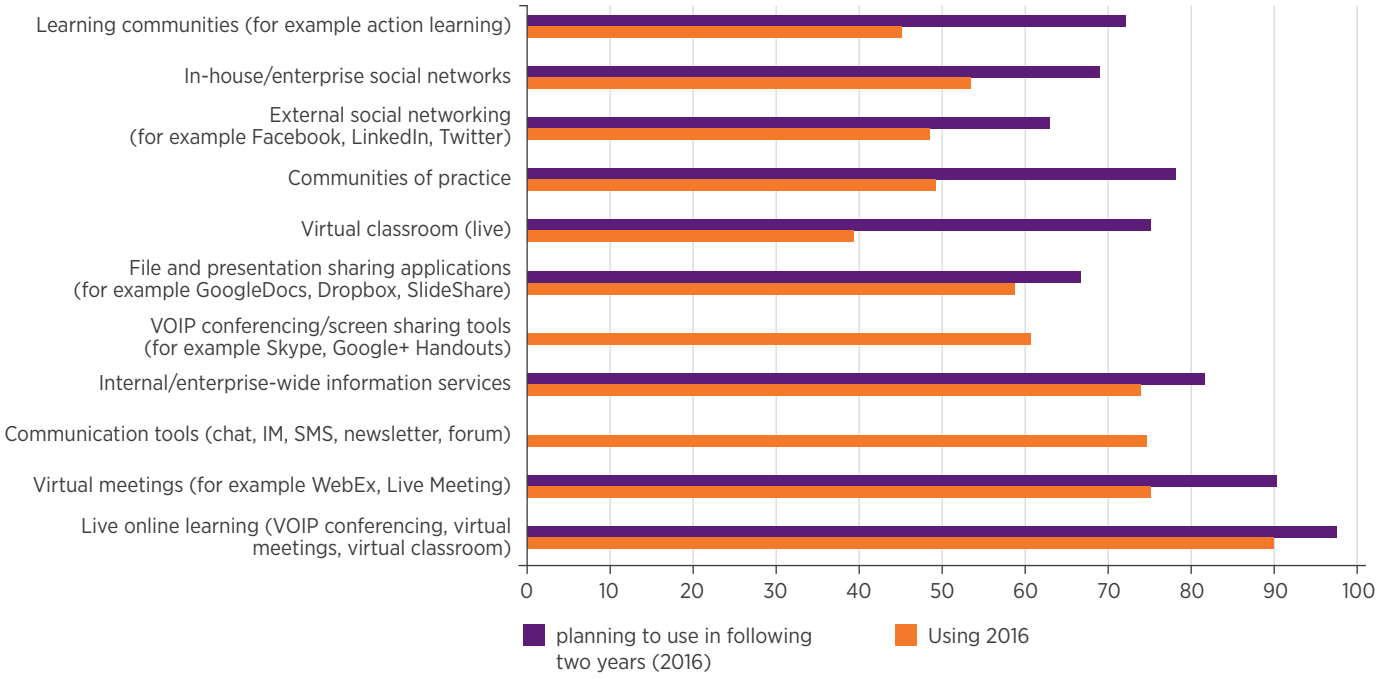


Figure 5: Collaborative learning tools used in 2016 compared with planned use in two years following 2016 (%)



Communities of practice were used by 48% in 2016, and learning communities/action learning sets used by 42%. Positively, 77% of respondents suggest they planned to use communities of practice in the next two years, highlighting a trend towards more truly collaborative tools. However, in previous years, use of these tools has been widely planned for but not translated to practice. This could be because these tools are more time-consuming to implement than other forms of technology.

Social networks have increased in use in recent years, a trend that looks set to continue. Slack, a technology that can be used as an internal social network and messaging tool, was released in 2013. Twenty-nine per cent of practitioners used social networks in 2012, rising to 44% in 2014 post-Slack release. Two years after launch, this figure rose to 50%. Sixty-eight per cent of practitioners now plan to use internal social networks in the next two years (as reported in 2016).

The part that social networks can play in collaborative learning initiatives is not clear, as effectiveness may vary by context and the purpose of implementation (Manca and Ranieri 2016). The value of social networks may be an indirect one; some research has suggested that social networks can increase participation in offline learning activities through increased interaction (Van Puijenbroek et al 2014). Given the aim of practitioners to encourage attendance of learning activities, this might be a focus for social network use in organisations.

In summary, collaborative learning tools refer to a wide variety of technologies, related to social learning theories. True 'social learning' refers to a more complex process than using networks or sharing files, and practitioners should be clear on what they want to achieve from collaborative tools and select them accordingly. If knowledge management and promoting offline learning is the key aim for technology, there are plenty of tools that facilitate this. Practitioners with a strategic aim to promote sharing user-generated content and facilitating continuous learning and reflection through collaborative learning should focus on tools and initiatives that are truly based in social learning theory.

Spotlight on mobile learning

Eighty per cent of practitioners in the Towards Maturity Benchmark survey (2016) are utilising some sort of mobile technology, an increase of 9% since 2013. In the next two years, 90% of practitioners plan to use some form of mobile technology.

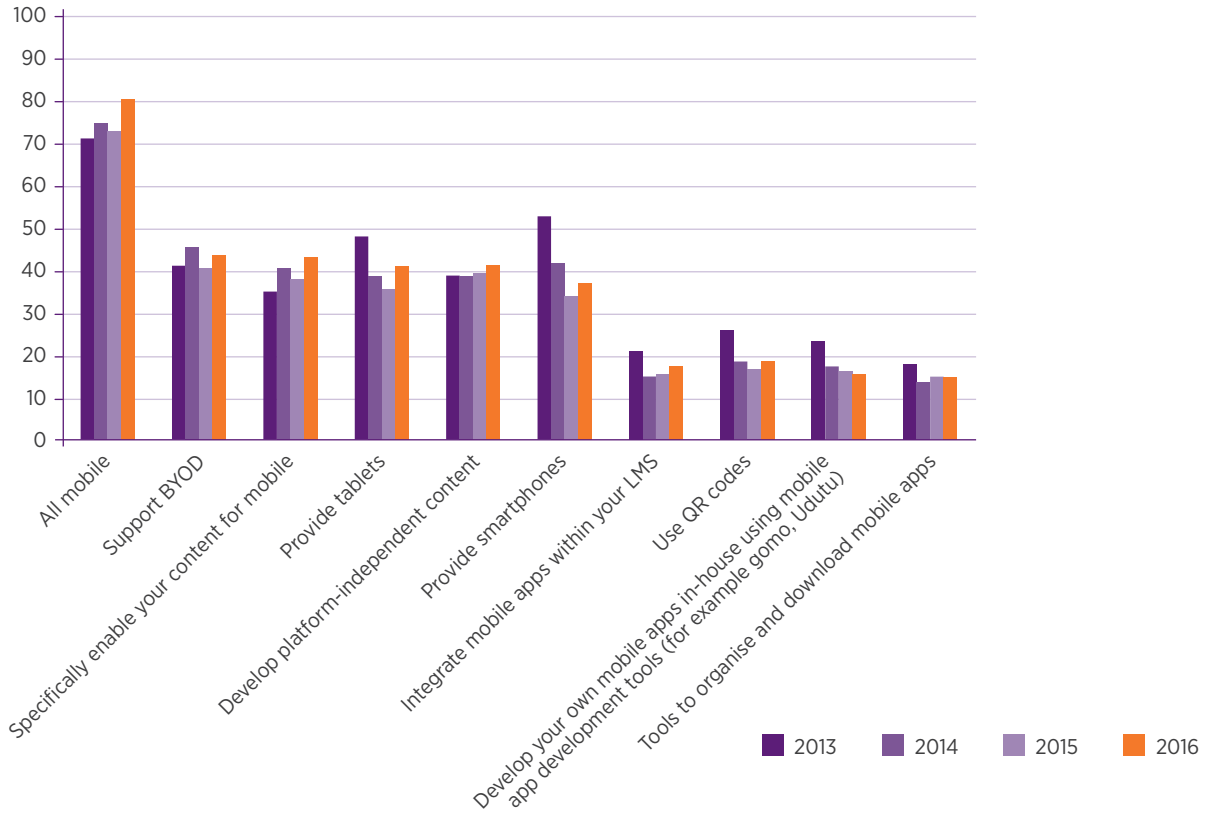
Thirty-seven per cent of practitioners provided smartphones that can be used for learning in 2016. This number has reduced by 15% since 2013. This might seem at odds with the aim of increasing access to learning; however, this decrease does not signal lower intentions to use mobile technology. Instead, there will be a focus on learners using their own devices; 57% of practitioners plan to support a 'bring your own device' (BYOD) policy in the next two years, an increase of 7% since 2013, reflecting a dual purpose of facilitating greater access to content while achieving cost-efficiency by learning on users' own devices.

This approach does come with additional barriers to effectiveness. For example, 51% of practitioners in the Towards Maturity Benchmark survey (2016) suggest that the variation of learners' mobile technology is a barrier to digital learning. The variety of devices means that it is difficult to ensure content works or is accessible by each individual, which inadvertently hinders the strategies of practitioners to increase access to learning.

Mobile is clearly being used for the practical aim of increased accessibility. However, given that six out of ten (59%) learners in the 2016 Towards Maturity Learner Voice Survey selected 'lack of time for self-study' as the number one barrier for learning, organisations need to pay particular attention to creating enabling environments for the learners to access content.

Mobile tools are being used to serve current content in a new way, with 43% respondents adapting content for mobile devices and 41% developing content that is platform-independent. However, only 17% integrate mobile apps with their learning management system (LMS), a slight decline since 2013, when 21% of organisations did this. This decline looks set to reverse, with 50% planning to integrate mobile apps with their LMS, 67% planning to specifically enable content for mobile devices, and 59% planning to develop content that is platform-independent.

Figure 6: Mobile tool usage, 2013–16 (%)

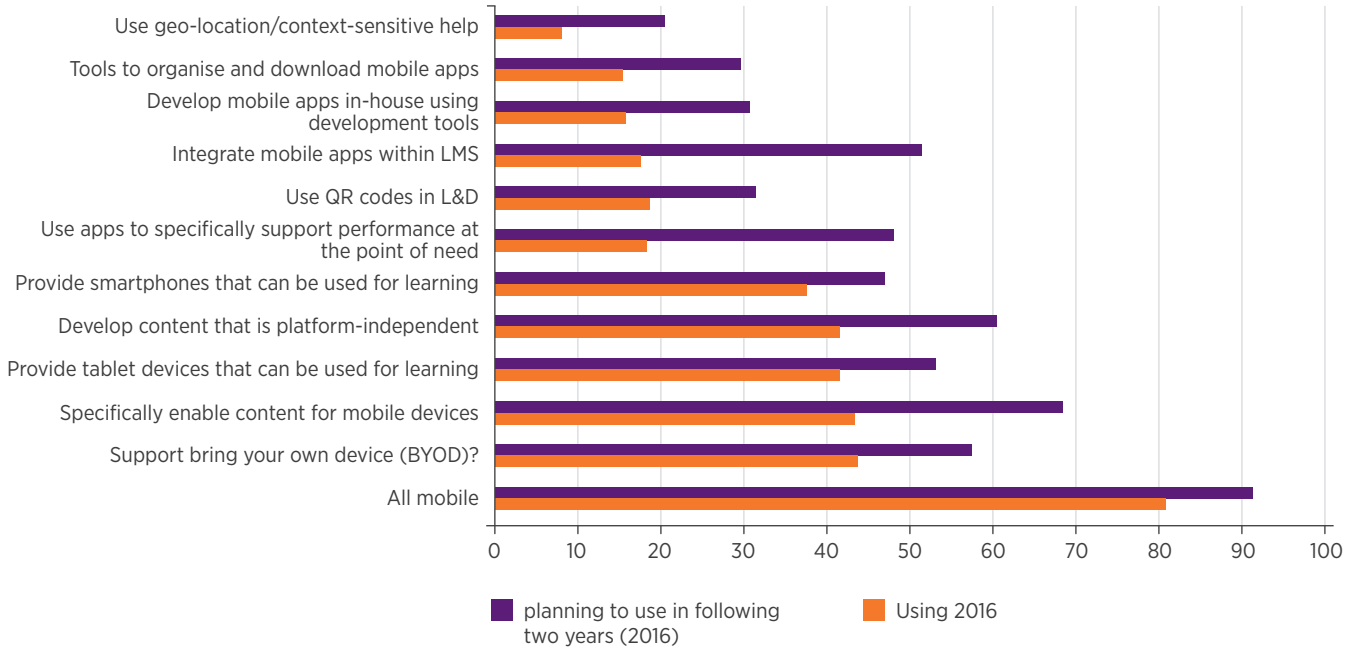


Thirty-five per cent of learners suggest that current digital learning is uninspiring, so there is a risk that the ability to access content across location and device will not lead to better uptake, especially since many practitioners plan to repurpose current content. To address this, practitioners should ensure the content designed or repurposed for mobile is well designed, collaborative or problem-based in nature (Sung et al 2016).

Almost half of practitioners plan to use mobile apps to support employees at the point of need (47%, in contrast to the 18% of practitioners that are currently doing this), suggesting that practitioners will increasingly use mobile devices to support point-in-time learning. However, a minority of practitioners are planning geo-location or context-sensitive help (20% planning to implement over the next two years), despite this being a powerful way to serve content at the point of need outside the training room. For example, serving information in a specific context outside a formal learning environment, using additional technologies such as QR codes, has been linked to positive outcomes (Sung et al 2016). By focusing on serving current content on mobile, practitioners may be missing out on some of the benefits of location-independent learning that can enhance point-in-time learning.

In summary, practitioners plan to use mobile as an additional vehicle for content delivery, primarily to increase support at the point of need. The extent to which this will meet organisational aims for flexible and higher-volume learning will be affected by a variety of factors, such as ensuring mobile content reflects the features needed for learning, and the ability for learners to access mobile content because of time and device constraints. Putting support in place to minimise these will be important in ensuring learners are able to take advantage of mobile devices.

Figure 7: Mobile tools used in 2016 compared with planned use in two years following 2016 (%)



Conclusions and framework

Today's learner is thought to be digitally literate and motivated, wishing to access learning in a flexible way. Technology allows access to learning away from the office, supporting the need for flexibility. Taken together, this points to an ideal future of learning where self-directed learners can access the required learning through any device, any time. In addition to this, technology releases happen regularly, with big promises and trend reports singing the praises of a mobile and collaborative future.

There are several caveats to this ideal future, however. Learners report that their number one barrier to learning is lack of time, followed by issues with content. Technology alone will not address these barriers, especially if this leads to the onus being on learners to access content, rather than organisations presuming that content can be accessed away from the workplace. The use of BYOD policies might complicate the issue further, with a variation in technology meaning the design of content across devices is increasingly complex. Practitioners should be aware of the added complexity of digital learning environments, especially for those who have low levels of digital literacy, and for self-directed environments where practitioners are not available to guide, facilitate or control what information is being shared.

What is clear from digital learning research is that technology-based learning can be effective, in some cases more so than classroom learning, but only when certain conditions are met. Specifically, interactivity, opportunity to practise, instructional method and learner characteristics are important factors that determine whether digital learning will be successful. This mirrors what we know about how people learn: integration of knowledge to real-life contexts is key for knowledge transfer.

As with any learning, the instructional methods and learning theories they draw on will be important determinants of success. The delivery method of digital learning does not possess any specific andragogic benefits other than flexibility of delivery – a practical factor rather than one that leads to an increase in learning, other than that is has the underlying capability to reach more people. These principles of learning are not novel; practitioners should implement technology that supports the right processes if they want to encourage learning.

Be clear on the purpose of the technology; don't implement technology for technology's sake

This report is not suggesting that technology shouldn't be used. Before investing in technology, however, practitioners should be clear about what they hope to achieve with the tool. If technology is being implemented purely for practical reasons (access to learning, online networking, knowledge management through file-sharing, for example), practitioners should be clear on the purpose

'What is clear from digital learning research is that technology-based learning can be effective, in some cases more so than classroom learning, but only when certain conditions are met.'

of technology and facilitate other learning experiences elsewhere. Equally, practitioners using technology for learning should not implement knowledge management systems without a strategy and other offline support to ensure the collaboration will occur off the back of knowledge-sharing. They might do better to invest in other types of technology, or to address why knowledge is not being shared, before turning to technology.

Critical considerations:

- In the war for talent, employers need to remain competitive, and technology adoption is one facet of this. The desire to be an early adopter of technology and fear of falling behind this curve is a real concern for employers, leading to quick uptake of technology. The aim to deliver response to business need is one that many practitioners feel they have not yet achieved, and pressure from senior management may add to this.
- Research shows that technology can be an effective tool, when used for the right purpose. Being clear on this purpose, and exploring different avenues to solve for the problem before immediately implementing technology should ensure that technology can truly deliver.
- Before investing, a clear strategy should be created for offline activities that will allow the investment to be successful, taking into account the organisational context, learner needs or learning content. Implementing technology to improve access to already useful learning, for example, will ensure an organisation remains competitive, more so than adopting a new technology without a clear strategy on how it will be used, which will be costly in the long term.

Select tools that will address the real learning challenge

Before implementing technology, practitioners should consider the problem to be solved. Does current learning have low uptake? Examine the factors behind this before implementing technology to solve for this. If the barriers to learning are factors such as learner motivation, learning characteristics, and lack of time, these barriers might be better solved offline first. Mobile technology, for example, is hoped to break down time and access barriers, but mobile learning is only as effective as the content it serves and can't solve fundamental issues such as lack of time.

If the only issue with the learning content is that an already effective learning course is not scalable or easily accessible, re-creating this in an identical (or near to) environment will likely allow more flexibility and good outcomes (especially if the digital learning environment contains more engaging elements).

By identical we mean that the material possesses the same learning characteristics, such as interactivity, practice, feedback and ability to transfer in context. It doesn't have to be done synchronously. These can be represented in different ways through technology (an online discussion board to supplement a self-directed digital learning course, for example, rather than a breakout session in a classroom course).

Critical considerations:

- How can we pinpoint the 'real' learning challenges, when different stakeholders in the organisation have different degrees of understanding of what the challenges are? A learner could perceive their challenge is not having time or encouragement to access learning, whereas a team leader could see lack of engagement with courses and perceive this as a lack of motivation from employees. When analysing learning needs, practitioners should take a multi-stakeholder perspective on why content isn't being accessed.
- Comparing learner satisfaction scores with learning outcome scores for different vehicles of learning will aid in understanding of the perceptions and acceptance of digital learning. Often, satisfaction scores are higher for offline learning, but learning outcomes remain unchanged, as much research suggests that technology-enabled learning can be as effective as offline methods.
- How does the technology align with other learning and development strategies? Is a move away from classroom learning and towards online learning taking place around limited learning budget and push towards employee self-direction in their learning? If so, practitioners should ensure that online learning is not seen as a second-rate option by employees and emphasise that technology, too, is an investment in development, but highlight the benefits of technology.

Understand if the technology is truly 'collaborative' or 'game-based'

With an array of trend reports singing the praises of mobile, collaborative and game-based learning, there is a danger that tools based on these theories are implemented in order to keep up with trends, but will not see the effects hoped for because they are a superficial form of the technologies.

For example, game-based learning elements such as leaderboards contain elements of games, but they do not provide the immersive, true-to-life environment that motivates and allows transfer of learning that a serious game does. These are a distilled version of concepts that have been researched and shown to be effective, but without implementing the full version, the same success might not be found.

Equally, collaborative learning is not as simple as implementing a social media tool such as a social network, or a file-sharing software where users can share files. While this has value, it does not have the capability to promote true social learning in the classic sense – reflection, collaboration and working towards a common goal within a more structured community might be a better way to facilitate this.

Critical considerations:

- There is a balancing act between innovation and learning theory. The answer is not to 'stand still' and be fearful of new technology. Collaborative and game-based learning are all supported by theory, but investment might not yield the results required if the real elements of what makes these tools effective are lost in translation when being applied in practice.
- Practitioners increasingly look to emerging technologies to deliver continuous, reflective learning, but implementing a tool will not achieve this aim without a supporting strategy, complemented by other organisational initiatives.
- Immersive environments can be very costly, and using elements of games and immersion can seem like a good option. However, similar results could be gained by other means, such as ensuring interactivity in instructions during learning and creating situated learning opportunities.
- Practitioners should weigh up the benefits of new emerging tools against the time and budget needed for implementation, ensuring that the resources needed will not have a knock-on effect on the quality and development of other learning in the organisation. There should also be ample time and support allowed to ensure the tool can reach its potential after implementation.

Apply what we know about offline learning to online learning

Learning will be most effective when it is relevant to employees, supported by the social context, and the learning itself is of high quality and possesses features such as interactivity, ability to practise, feedback, and reflection. Once the learning experience is over, there must be ability to practise the skills learned, and a salient reason to do so.

A variety of research has highlighted these features as being imperative for online learning to be a success. Implementing technology and learning that does not have these features will not lead to strong outcomes, regardless of whether more employees can access it. If technology is being used, practitioners need to ensure that other forms of learning accompany it for the best outcomes, as blended learning has widely been highlighted as the optimum delivery method.

Critical considerations:

- Applying theories of offline learning to online learning may not be a simple task, especially

'Learning will be most effective when it is relevant to employees, supported by the social context, and the learning itself is of high quality and possesses features such as interactivity, ability to practise, feedback, and reflection.'

given the informal nature of some tools. For example, how do we ensure technology-based social learning reflects offline discussion and knowledge-sharing, which is often informal? Selecting collaborative tools and wider initiatives that facilitate discussion and reflection in a real-world context is a good place to start.

- We know that blended learning relates to the best outcomes. Technology-enabled learning experiences should not always be standalone but should involve different aspects, such as follow-up offline sessions or online discussion. Practitioners are under pressure to deliver a quick, easy-to-digest response to business challenges, but we know that learning is more than serving information.

Learning technology framework

This report has discussed the factors associated with technology implementation and effectiveness. The needs of learners, organisational context, learning principles and technology trends are all likely to influence the implementation of technology.

Based on the current evidence, the framework in Table 7 outlines the key principles behind this and a checklist of questions that practitioners can use when selecting technology.

Table 7: Learning technology framework

Factors influencing technology implementation	Checklist
Organisational context • Organisational factors such as culture and business strategy will affect the success of technology. • Practitioners have great knowledge of their own organisations; this should be used to identify barriers to technology effectiveness. • Organisational barriers to offline learning should inform the strategy behind the implementation of technology to address these issues.	☐ What are the barriers to learning in your organisation, as perceived by a variety of stakeholders? How can these be addressed with technology? ☐ Is the organisational context supportive of the technology? Do users have the time and support to both access and contribute to collaborative and user-generated content? ☐ Are there other barriers to the technology being utilised correctly, from security and control issues to learner motivations? If so, what strategy is in place to mitigate these?
Learner needs • Learners have varying levels of digital literacy, and attitudes towards technology use will differ across employees. • Learners can be self-directed, but motivation to learn varies across context and between individuals. • Learners lack time and ability to access learning material; technology can help make information available away from a specific location to allow for better access, but shouldn't be used to promote learning only away from the workplace.	☐ Have any conclusions been drawn about the digital confidence in the organisation? ☐ How have previous technologies been received? If not positive, have the objections been addressed? ☐ Do learners have the time to access content in the working day, and is access to learning encouraged by managers? ☐ Where learning is asynchronous, or requires self-direction, is clear guidance and signposts for assistance available, along with a strategy to manage dropout? ☐ Do users have the correct tools (whether that be mobile devices or traditional computers) to access learning? Do they have the time to do this?

Table 7: continued

Factors influencing technology implementation	Checklist
Purpose of technology • The success of technology implementation will be strongly influenced by how well the characteristics of the tool match the purpose of implementation. • If technology is being implemented for technology's sake, it will not lead to positive outcomes. • File-sharing tools, for example, will not lead to continuous, reflective learning, but they can aid knowledge management and help sharing across locations if implemented correctly and where appropriate.	☐ Is the purpose of the technology project clear, and can the technology truly deliver on these objectives? ☐ If the technology is being used to connect employees or for knowledge management, rather than as a learning environment, has a strategy for measuring ROI been decided? ☐ If the technology is being implemented as a practical way to connect learners or act as a content repository, is learning being prioritised elsewhere? ☐ What other avenues are in place to support the technology, ensuring a blended approach? ☐ How will the technology be supported over time to realise potential long-term benefits?
Learning principles and evidence • The principles of learning remain constant online and offline. • Be cognisant of learning principles such as andragogy[3] and social cognitive theory to evaluate whether the technology can deliver true learning. • Digital learning literature has also highlighted several factors associated with positive learning outcomes, such as interactivity and opportunity for practice. [3] Popularised by Knowles (1980), andragogy refers to adult learning principles such as; self-direction, utilising user knowledge for learning, and tutors facilitating learning rather than instructing. For further information, see page 12 of this report.	☐ Does the technology allow for interactivity, practice, reflection? If not, are there other activities that can be undertaken alongside the technology to allow this? ☐ If the technology is serving current, well-utilised content across domains, does it possess the same features when adapted for online use? ☐ If the technology will be serving current content repurposed for digital use, is the current content well evaluated by learners? If not, how will the technology make the content more engaging? ☐ Does the content served by technology relate to a real-world problem or situation? Is it clear how the learner will use this in their role, or for future development?
Technology trends • Trend reports and vendors provide compelling reasons for implementing new technology, but confusion arises around the definition of new tools such as mobile, collaborative and game-based learning. • Use critical questions to evaluate new technologies and whether they are supported by theory. • Use sources of evidence from education and technology research to identify success factors.	☐ Is the adoption of technology driven by learner needs or technology trends? ☐ Is there evidence for the capability of the technology over and above trend reports? ☐ We know that learning takes place when technology allows interactivity, reflection, and is similar to the real-world environment. Does the new emerging technology have the ability to do this? ☐ Is the technology truly collaborative, or game-based learning, or is it a content repository or motivational tool? If not, is it fit for purpose? ☐ What should be shared with collaborative technology? Have you identified what information you'd like to be shared and do you understand how to measure this?

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Appendix

Towards Maturity Benchmark Survey data sources

The main sources of data for the Towards Maturity Benchmark are:

1 **Online Benchmark review through the Benchmark Centre**
Individuals who have taken part in previous studies with Towards Maturity are invited to review their learning and development strategy using an online Benchmark Centre. The review is a seven-stage in-depth process which the L&D leader can revisit repeatedly to check and update their answers as their circumstances and approaches change.

2 **Online Benchmark review through an online survey tool**
Individuals with responsibility for modernising learning strategy in the workplace are invited to participate in an online review. The online review mirrors the questions in the Benchmark Centre.

3 **Learning Landscape**
To date, Towards Maturity houses over 40,000 learners and their perceptions, motivations, habits, and actions in its database, which are captured through its Learning Landscape service.

Literature review evidence

Topic	Author	Findings	Implications
Digital literacy	Park and Wentling (2007)	The authors examined the factors that are associated with digital learning training transfer specifically, highlighting that user attitudes towards the technology that delivers training could be an important factor in success. The study used survey data to measure student outcomes in a US university setting, both attitudes towards technology and perceived transfer. Computer confidence was correlated with transfer outcomes, and perceived usability significantly correlated with breadth and frequency of transfer.	This suggests that when online training is not perceived as usable, students feel they use the skills less often, and less widely.
	Park and Wentling (2007)	The authors found that digital literacy affected use of web 2.0 tools such as blogs in the workplace. In a study conducted in a New Zealand accountancy firm, those with lower levels of digital literacy were less likely to believe these tools would have an impact on performance. In turn, those that perceived that web 2.0 tools would have an impact on performance were more likely to intend to continue using the tools.	Digital literacy also affects perceptions of the usefulness of tools, and the continuation intentions of users. Making clear the purpose of online tools is very important.

Literature review evidence (continued)

Topic	Author	Findings	Implications
Learner characteristics	Santhanam et al (2008)	This research took a quasi-experimental study approach with undergraduates selecting to undertake an IT online course for course credit in a US university. During the training, an experimental group were presented with scripts highlighting how critical the skills were that they were learning, emphasising that they were capable learners and reminding them to stay focused on the task at hand. A control group was provided with generic instruction. Those in the experimental group had improved learning outcomes when compared with the control group, after self-regulation and self-efficacy were controlled for.	This suggests that tailored instructions can aid in student outcomes, and also suggests that encouragement and facilitation can aid learning outcomes and encourage self-directed engagement in courses. Practitioners could use prompts appropriate for their audience in digital learning courses to ensure engagement with content.
	Howland and Moore (2002)	This study found that when students positively perceived their online distance course, they exhibited more self-directed learning strategies. The causality of this relationship is not clear, as those with a more self-directed approach to learning may have more positive perceptions of courses.	Self-directedness is a concept that is not constant amongst all adults, or indeed situations. Practitioners should also be clear on the perceptions and digital ability of their workforce and plan support around technology accordingly.
	Bernard et al (2004)	This meta-analysis compares the effectiveness of distance education and classroom education, including related studies from 1985–2002. Although this research is fairly dated, it covers nearly 200 studies on distance education in order to examine the teaching method and medium and the effects of these factors on learning outcomes. The authors identified that there were different factors associated with positive learning outcomes depending on whether the learning was delivered synchronously or asynchronously. In asynchronous learning, for example, dropout was much higher; opportunity for interaction with a tutor and problem-based learning strategies were amongst the features related to good outcomes. For synchronous distance learning, interaction with other students was implicated for good outcomes.	This is not to say learner–tutor interaction is not important in synchronous learning; it may be that the synchronous nature of learning means the interaction is already present in the design of the learning.

Literature review evidence (continued)

Topic	Author	Findings	Implications
Digital learning effectiveness	Means et al (2013)	One meta-analysis studied the differences between effectiveness of blended, online and classroom instruction. The analysis included 175 studies of various learner age groups and, interestingly, found no differences between these age groups regarding the effectiveness of different instruction types. Blended instruction had advantage over face-to-face instruction and online learning, but with a larger difference between blended and face-to-face learning.	This research suggests that a blend of classroom and online learning can lead to more positive outcomes. The authors cautioned that the results should not be interpreted as unequivocal support for blended learning, and identified several moderating factors to this relationship. For example, the learning approach used in the training was a significant moderator of outcomes, with collaborative and expository instruction leading to better outcomes in blended learning, but not independent online learning. Given the move towards more independent, self-directed learning, it is worth noting that instruction and guidance can lead to better outcomes in certain contexts.
	Cook et al (2010)	This review looked exclusively at online learning in a workplace setting, namely the healthcare sector. They reviewed 51 studies, and found the high interactivity, practice exercises, feedback and repetition were related to better learning outcomes. However, the authors noted that there was substantial variations in outcomes and that firm conclusions should not be drawn.	Other organisational factors are likely to influence the outcomes of training, such as organisational support, as is the case with offline training.
	Sitzmann et al (2006)	The authors conducted a meta-analysis to compare the effectiveness of classroom-based versus web-based training methods. They also compared effectiveness for the acquisition of declarative or procedural knowledge. Overall, web-based instruction was more effective than classroom-based instruction for learning of declarative knowledge, but there was no statistically significant difference between the methods for teaching procedural knowledge. However, a blended approach of web-based and classroom training was more effective than classroom training alone for both types of knowledge (although learner reactions were more favoured towards classroom training). Another moderating factor of learning outcomes was learner choice; when participants were randomly assigned to web- or classroom-based learning, classroom training became more effective for learning declarative knowledge. Other factors identified in the meta-analysis were human interaction, practice and feedback, and length of training, all of which moderated the relationship between type of training and learning outcomes.	When instructional methods were taken into account, there was a larger disparity in the effectiveness of each training type, suggesting that the instructional method, whether web-based or 'offline', is a key part of the effectiveness of training. When participants self-selected into web-based learning, this method was most effective. This suggests that learner choice and control is implicated in learning outcomes. For web-based training in particular, the opportunity for feedback and practice enhanced the effectiveness of the training.

Literature review evidence (continued)

Topic	Author	Findings	Implications
Game-based learning	Sitzmann (2011)	Sitzmann (2011) conducted a meta-analysis of 55 studies and found that computer-based simulation games were more effective than control groups of non-game-based methods. This was in terms of post-training efficacy as well as knowledge outcomes. This was moderated by the instruction method; where passive instructions were given, game-based methods were less effective than comparison group measures. In contrast, interactive instructions led to better outcomes in game-based learning. The only variable that could independently account for variance was the overall learning method. The positive effects of game-based instruction only held up when the game was part of a wider method of instruction. When the game was the only method of instruction, game-based learning was no longer more effective. In contrast, when control groups were fully engaged throughout their training, the learning outcomes were higher than the simulation-based game.	No one factor completely accounted for the variance in outcomes, suggesting that other factors not identified influence the effectiveness of game-based learning.
Collaborative learning	Breunig (2016)	This qualitative study analysed the use of in-house wiki social network sites for social collaboration, which had been implemented to allow rapid access to shared knowledge, moving information-sharing away from emails. Interviews were conducted with colleagues from several global locations. Colleagues reported learning experiences when the wiki system was used for collaboration to solve daily challenges, and the technology was felt to remove barriers between locations.	This challenges the notion that social learning cannot happen online, and can be useful for connecting global audiences.
	Barbara and Dina (2006)	This case study explored a COP in the UK healthcare sector. Users found the communities of practice helpful, and data collected from the system indicated high levels of usage over the course of the study, including out of office hours, indicating the flexible access times afforded by the technology were used. However, for the communities to be successful, users identified manager support and time to access as particularly important. Work–life balance being disrupted was reported by some learners who had commitments outside of work hours and could not access technology during work hours. If communities of practice lack reciprocity and learners lack security to share ideas, learning will be limited. COPs are arguably the most time-consuming and complex aspects of collaborative learning; however, they are most clearly linked to learning process theories.	The authors suggest that anyone facilitating a COP should be mindful of the time constraints, and ensure wider support for the time needed to take part by managers and organisations. Challenges faced by offline social networks and communities of practice (such as time, and lack of participation) will pervade online versions of these tools; if time is already a barrier, allowing users to access communities from home will not solve the issue.

Literature review evidence (continued)

Topic	Author	Findings	Implications
	Manca and Ranieri (2016)	This study found mixed results for the success and use of Facebook as a learning tool in a variety of education-based settings. 23 recent studies were identified. The authors found that the tool was often selected because instructors believed students would already be familiar with the environment, and was most often used as a place for student discussion, followed by content development. The reasons for implementation often differ, with some using it as a way to encourage informal sharing, and others for discussion of formal education topics. Some studies suggested the use of Facebook resulted in more collaboration between students than a traditional learning tool, whereas other studies suggested that Facebook was not being accessed by students of a MOOC course, primarily because of privacy concerns.	Overall, the review suggests that the effectiveness of this tool will vary by context and the purpose of the tool. A limitation of this research is that it refers largely to traditional education settings, so may not identify some of the key concerns for workplaces.
	London (2013)	The author conducted a case study in a professional services organisation with globally dispersed teams to explore which factors impact on successful knowledge-sharing in social networks. In the system used, user-generated wikis were encouraged as a way to share information on technical issues with colleagues across different global locations. Overall, the implementation of the social network was perceived as a success, as it provided an avenue for employees to share their learnings across offices where there were knowledge gaps, and to apply their learning by translating this into written form for others. They also noted that pre-existing social networks within offices affected how employees interacted, but having a personal element (such as a colleague writing the wiki) gave more credence to what was being written.	This research concerns individual organisations, and cannot be generalised across contexts for this reason. However, it does suggest that when collaboration tools are used effectively, learning experiences can occur from collaboration, and international knowledge-sharing can increase.
	Van Puijenbroek et al (2014)	In a study of social network uses in an organisation based in the Netherlands, survey data suggested that social media will be most effective in organisations that already encourage collaboration, and that social networks would increase participation in learning activities. The researchers did find that social media usage did lead to increased participation in learning activities, but their hypothesis that organisational culture would moderate this relationship was not confirmed. However, organisational culture did relate to levels of on-the-job learning.	This suggests that social networks might be a useful tool in promoting training initiatives. It also highlights that organisational culture relates to whether on-the-job learning might take place, and this should be a concern for practitioners.

Literature review evidence (continued)

Topic	Author	Findings	Implications
Mobile learning	Vorley and Williams (2016)	The students in this study took part in a course that promoted effectual thinking, a process linked to entrepreneurial success. Students were given either process-based information on the topic in a classroom, method- and practice-based information in a classroom setting, or a blend of method-based classroom instruction and process-based information via smartphone application. The method- and practice-based students (in both the classroom and blended condition) had better course outcomes than the classroom-based process students. Delivering learning in multiple instructional formats was related to better outcomes, whether the information was given via mobile or not. Interestingly, student perceptions of the course were more positive in the group where both delivery methods took place in a classroom setting, rather than in a blended approach.	This study suggests that the design of training is more important than the vehicle by which it is delivered. Practitioners should be mindful of how information is delivered (is it oriented towards a problem, is it purely based on learning facts?), as this will influence learning outcomes more so than the vehicle for delivery.

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