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Bridging Formal and Informal Learning through Technology in the 21st Century: Issues and Challenges

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Abstract

This chapter presents a comprehensive review of the current debates surrounding bridging informal and formal learning, from the perspective of improving the learner's experience in formal educational provision. Firstly, the chapter reviews the literature defining informal and formal learning, noting the complexity and the lack of consensus. Secondly, it discusses how

technology can be used to bridge learning through harnessing the digital practices that young people engage with informally such as social networking, game-based learning and digital making. The authors then outline some pedagogical issues which need to be considered to maximise the potential of bridging formal and informal learning. Next, the pedagogical strategies needed to enhance learners' opportunities for autonomy, collaboration and authentic learning are discussed. The chapter also explores the divides, cultural tensions and ethical concerns that shape practices such as the constraints of a performativity culture and the invasion of young people's private space. A vignette of a project in India is presented as an illustration of good practice. Here, despite limited access to technology, young people have been supported to engage in authentic learning projects involving the creation of digital artefacts, both in and out of school. The chapter concludes by arguing that there must be a shift from transmissive to collaborative pedagogical strategies; school cultures need to change. In order to do so, teachers need professional development and support to take risks and experiment. More research is needed so that the interrelationship between technology-enabled formal and informal learning can be better understood but also because good models of practice need to be identified and shared.

Bridging Formal and Informal Learning through Technology in the 21st Century: Issues and Challenges

Formal learning (education and training), broadly conceived as organised through educational institutions and leading to recognised qualifications, is considered by many to be the tip of the iceberg. (See, for example, Rajala, Kumpulainen, Hilppö, Paanenen, & Lipponen, 2016; Rogers, 2014; Yang, 2015; Werquin, 2010). That is, learning can and does take place in many different contexts beyond formalised schooling including after school clubs, homes, peer cultures, museums, galleries and other community settings.

Technology, such as social media and mobile devices, offers many benefits for informal learning. Many argue that technology changes the way people learn through enabling new and more immediate ways of accessing and creating knowledge shaped through social interaction, increased ability to cross time and space, and new modes of representation (Banks et al., 2007; Cox, 2013; Davies & Eynon, 2015; Erstad & Sefton-Green, 2013). Technology enables young people to engage in participatory and collaborative models of knowledge production that are interest-driven and authentic, with increased agency and opportunities to develop new skills (Ito et al., 2013). However, many young people only engage in passive interaction such as communicating with their friends and posting photographs in social networks rather than creating, editing or remixing digital artefacts (Clark, Logan, Luckin, Mee, & Oliver, 2009).

Technology can disrupt the boundaries between types and sites of learning (Greenhow & Lewin, 2016) (see also Kumpalainen, Mikkola & Rajala, 2018 in this Handbook). Formal educational institutions are increasingly trying to harness the potential of technology for making connections to the different types of learning that take place (Ito et al., 2013; Rajala

et al., 2016). This is often driven by political demands to improve outcomes and address issues such as student retention by making learning more engaging and relevant (Kumpulainen & Mikkola, 2016). However, this shift in school culture is not without its tensions as outlined below.

This chapter reviews the current debates surrounding the conceptualisation of informal, non-formal and formal learning. It then considers recent attempts to bridge young people's formal and in/non-formal learning through the adoption of technology. In the light of this shift in focus, the chapter discusses some of the pedagogical issues arising as educationalists attempt to realise this vision. In an attempt to avoid a biased Western view, it then presents an exemplar of a project in India designed to connect learning across sites. Finally, it concludes by highlighting future challenges and considering the implications for life-long learning.

Conceptualising Informal Learning

As noted by many, there is a lack of consensus regarding the complex, slippery concepts of in/non-/formal learning (Colley, Hodkinson, & Malcolm, 2003; Sefton-Green, 2004; Sefton-Green, 2013; Rogers, 2014; Werquin, 2010). Policy makers, alongside others, have presented discrete definitions of the concepts and avoided discussion of the difficulties in doing so (Eshach, 2007; The World Bank, 2003; UNESCO, 2012). However, as Sefton-Green (2013, p.18) notes, "it is easy to think of exceptions and challenges" to discrete definitions. In response, many have argued that instead of viewing these terms as discrete they should be viewed as on a continuum (Lai, Khaddage, & Knezek, 2013; Werquin, 2010; Yang, 2015). That is, definitions should be relative rather than absolute as conceptualising each term as distinct and bounded is impossible (Sefton-Green, 2013). In acknowledging the struggles of many who have focused on this area, Colley and colleagues (2003) argue that "It is more sensible to see *attributes of formality and informality* (emphasis as in original) as present in

all learning situations" (p.29). This conceptualisation is becoming increasingly more important as pedagogical practices combining formal and informal attributes to varying degrees become more commonplace in educational contexts (Weigel, James, & Gardner, 2009).

It is insufficient to define formal and informal learning according to where it takes place (Sefton-Green, 2004); instead, it is more important to consider the purpose and structure of the learning (Sefton-Green, 2004). Informal learning can thus be broadly conceived as "what happens outside the structures and boundaries of formal education, the topic or focus of which is determined by the person doing the learning, on their own or with others" (Davies & Eynon, 2015, p.330). Informal learning is concrete, interest and practice-driven, open-ended and highly contextualised (Arnesen, Elstad, Salomon, & Vavik, 2016; Lemke, Lecusay, Cole & Michalchik, 2015) as compared to the relatively abstract and decontextualized knowledge delivered through formal education. Informal learning may not always be planned; rather it may be reactive and spontaneous (Eschach, 2007). It may also include incidental learning, described as "the everyday experiences through which we learn a great deal without ever being conscious of 'learning'" (Rogers, 2014, p.18).

A distinction is also often made between non-formal learning and informal learning. Non-formal learning is commonly used to describe planned but flexible learning that takes place in after-school programmes and other activities held outside school hours, in and out-of-school (Eschach, 2007). These activities are organised to some degree around purposeful activities (e.g., football training) but the learner has more agency and choice than in formal settings and more opportunities for social engagement (Lemke et al., 2015; Sefton-Green, 2013).

More recently, some researchers have avoided the regular use of the terms in/non-/formal learning (and thus the need to conceptualise them), instead referring to sites of learning

across space and time including in-school and out-of-school (Erstad, 2012; Rajala et al., 2016). In their 'learning lives' young people are conceptualised "as learners [moving] between different contexts of learning, both offline and online, in a constant flow of activities" (Erstad, 2012, p.26). This conceptualisation focuses on boundaries and boundary crossings between different learning practices, which demand ongoing complex negotiations (Erstad, Gilje, & Arnseth, 2013).

Bridging Formal and In/Non-formal Learning: The Role of Technology

The benefits of connecting to informal learning practices include authenticity, greater engagement, development of social capital, opportunities to develop 21st century skills and the potential to enhance learning (Banks et al., 2007; Hung, Lee, & Kim, 2012; Ito et al., 2013; Lemke et al., 2015). Many recent initiatives have tried to capture informal learning and 'institutionalise' it (Erstad & Sefton-Green, 2013). Everyday experiences are important learning opportunities that can support many different curriculum areas. Schools can draw on everyday knowledge and skills held not only by young people but also their families and the wider community, thus involving a wider range of 'teachers' (including the students themselves) (Banks et al., 2007; Erstad et al., 2013; Kumpulainen & Mikkola, 2016). Life-long learning policies are also being developed to formally recognise, validate and accredit the in/non-formal learning that occurs outside formal education (eg home, community, workplace) for young people and adults (see Werquin, 2010; Yang, 2015).

The rapid uptake of technology in many societies and the developing digital youth culture has generated greater interest from policy makers, educators and academics in bridging formal and in/non-formal learning (Erstad & Sefton-Green, 2013; Sefton-Green & Erstad, 2016). Technology has created new possibilities for connecting learning taking place in different sites, connecting people with shared interests and expertise, and for integrating informal

attributes within formal learning practices (Laru & Järvelä, 2015). Concerns have been repeatedly raised about the mismatch between young people's digital practices in- and out-of-school, often described as a 'disconnect' (e.g. Clark et al., 2009; Erstad & Sefton-Green, 2013; Ito et al., 2013). School needs to be viewed not in opposition to youth culture but as "an important part of a network of learning contexts that optimally create a supportive ecosystem for engagement and learning for a diverse range of students" (Kumpulainen & Mikkola, 2016, p.32).

Non-formal learning is perhaps a special case in relation to bridging formal and informal learning. After-school clubs can connect academic and everyday knowledge, enabling students to focus on interest-driven activities with more flexibility and without high-stakes testing but still with recognisable benefits for academic learning outcomes (Deng, Connelly, & Lau, 2016; NRC, 2015). However, schools do not provide enough opportunities for non-formal learning as part of their standard offer to students although most teachers recognise its academic value (Birdwell, Scott, & Koninckx, 2015).

Many argue that schools should take account of young people's uses of technology outside formal education although Crook (2012) cautions that digital practices are shaped by context leading to tensions if they are imported from one to another. Young people's everyday digital practices can complement formal education but may require what counts as knowledge to be reconceptualised (Sefton-Green, 2004). Additionally, the informal skills and practices developed through social media, gaming, mobile learning, engaging in online communities and digital making can be appropriated in the classroom to support schoolwork when it seems beneficial to do so (Erstad et al., 2013).

Social media can readily be used to support discussion and collaboration (Chen & Bryor, 2012) and a participatory culture (Mao, 2014) both within the classroom and beyond,

including with experts and community members when appropriate. However, uptake in the classroom remains low, lacks purpose or is tightly structured (Mao, 2014) despite interest in its potential for over 10 years (Crook, 2012). Young people may utilise such technology informally to gain peer support outside the classroom (Schuck, Kearney, & Burden, 2017) but little is known about the extent of such use. Alternatively, personal learning environments have been proposed as formal mechanisms for harnessing social media and other digital tools to support self-regulated learning through access to informal networks and peers, access to additional content, and sharing and co-creating knowledge (Dabbagh & Kitsantas, 2012). However, young people are not making the most of the opportunities that social media offers for supporting formal learning, partly because they do not possess the skills to do so effectively (Clark et al., 2009; Dabbagh & Kitsantas, 2012).

Game-based learning is another popular youth pastime which has been proposed as a means of supporting learning in classrooms for decades. Kluge (2016) concludes that teacher support and scaffolding is required in order to make connections between game playing and academic learning as the transfer of learning from games does not always take place, even with games designed to explicitly support learning and used in classroom contexts. He suggests that young people engaging in trial and error gaming strategies as a means of improving game results can undermine the learning aims built into educational games. Therefore, even though game-based learning can be very engaging for students it may not facilitate productive learning. From a different perspective, Brevik (2016) suggests that gaming outside school can have a positive impact on language development. However, the students involved in this study did not make connections between their development of English outside school and their language use in school, supporting the argument for teacher support to maximise learning opportunities.

Seamless learning, facilitated by mobile technologies, enables "a continuity of the learning experience across different scenarios or contexts" (Chan et al., 2006, p.23) enabling collaboration, personalisation and authentic learning to take place (Schuck et al., 2017). Seamless learners are viewed as being on a spectrum from those who self-direct their learning to those requiring more structure and support (Sharples, 2015); that is, as with formal and informal learning, self-directed and facilitated learning are not discrete polar opposites. Boticki, Baksa, Seow, and Looi (2015) developed a mobile learning platform for primary aged children enabling them to spontaneously capture media, comment and share. Students also received prompts, either periodically or triggered by location, to scaffold learning. The intention was that young people would use the technology for both teacher-directed and self-initiated activities linked to school learning. However, students mainly undertook teacher-directed activities; the authors conclude that self-initiated activities still require teachers' pedagogical support and structure.

In developing nations like India where access to education remains difficult in the rural and remote areas, mobile technology offers tremendous potential (Adhikari, 2014; Brewer et al., 2005). Where other basic infrastructure and technology has failed, mobile technology use has grown even in the remotest areas of India, which now has the second largest user base in the world (Raman, 2014). However, whilst its potential to support learning has been explored at the higher education level through platforms such as MOOCS, its adoption in school education has yet to take place. Reasons could include the lack of pedagogical knowledge for connecting formal and in/non-formal education and too much emphasis on content creation, which is difficult to customize for the many local languages and culture. A similar trend of low uptake occurs in adult learning: 80% Indian employees find mobile learning useful, but only 27% of the companies have adopted this approach for capacity building of their employees (Srivastava, 2015).

Online communities enable people with shared interests to come together. Connected learning "is that which is socially embedded, interest-driven, and oriented toward educational, economic, or political opportunity" (Ito et al., 2013, p.6). Drawing on learners' interests can beneficially connect learning across sites (Weigel et al., 2009) developing skills such as resilience and adaptability, and a positive disposition to academic learning (Ito et al., 2013). Technology is central to this approach, facilitating greater opportunities for access to knowledge, information and supportive communities, and the means to produce multimodal digital artefacts (Kumpulainen & Sefton-Green, 2014). Ito and colleagues (2013) suggest that connected learning can be facilitated through creating opportunities for students to engage in creative and collaborative project work strongly linked to their own interests, with an emphasis on production and performance.

The maker movement is growing in after-school settings (Peppler & Bender, 2013), one aspect of which is digital making (Quinlan, 2015) whilst much maker activity draws on technology in some way. Making generally involves the collaborative pursuit of technical projects related to personal interest and include 3D printing, programming and e-textiles. Making can develop skills in creativity, computational thinking, evaluation, reflection, collaboration, communication, problem solving and resilience, and contribute to learning outcomes (McKay & Peppler, 2013). It provides strong connections both to everyday practices and academic knowledge. It is already being appropriated in school contexts for open-ended and interest-driven activities where institutional structures allow (McKay & Peppler, 2013).

Technology can also be used to bring informal resources into the classroom. Stocklmayer, Rennie and Gilbert (2010) describe how students in Australia accessed presentations given by staff at a science centre through video-conferencing; here technology acts as a technical bridge connecting to learning resources outside the classroom. Virtual reality is another such

example, providing opportunities for learners to experience 'authentic' contexts such as geographical and historical sites that they might not otherwise be able to do (Freina & Ott, 2015). This can also be achieved through simpler technologies; for example, lower socio-economic children at a learning centre in Kolkata, India were able to explore the Taj Mahal and its history through videos, and London through google searching.

Pedagogical Issues in Using Digital Technologies to Integrate Informal Learning Practices in Formal Education

As discussed above, bridging formal and informal learning through technology fosters connected, authentic and seamless learning across settings. However, this bridging remains a major pedagogical challenge, with limited uptake to date, despite the growing interest from policy makers and practitioners in doing so (Khaddage, Müller, & Flintoff, 2016; Lai et al., 2013; Rajala et al., 2016). The ubiquitous nature of technology has made the learning landscape more complex thus increasing the 'transfer problems' (the difficulties of applying knowledge in new contexts) that occur in transitions between spaces (Illeris, 2009). Bridging learning through technology demands pedagogical change to ensure that everyday practices and knowledge are integrated and assessed in meaningful ways (Kumpulainen & Mikkola 2016; Lai et al., 2013). The need for teacher professional development in digital pedagogical practices has always remained an important factor to integrate technology in school classrooms (Chen & Bryor, 2012). However, teachers also need specific professional development in non-formal pedagogies (Birdwell et al., 2015; Quinlan, 2015). Without pedagogical change, technology may be used to replicate rather than enhance existing practices (Erstad & Sefton-Green, 2013; Khaddage et al., 2016).

Pedagogical strategies for bridging formal and informal.

It is suggested that traditional formal pedagogies focus on the individual rather than the socio-collective more commonly found in informal learning (Deng et al., 2016; Hung et al.,

2012). A variety of pedagogical strategies commonly found in out-of-school contexts could however be incorporated into formal learning, using technology, to ensure that learning in the classroom is more social, participatory, experiential and experimental (Deng et al 2016; Hung et al., 2012).

Informal learning strategies can be introduced through project, inquiry and problem-based learning approaches facilitating authentic and experiential tasks (Banks et al., 2007; Erstad, 2012; Illeris, 2009). The adoption of informal learning practices (concrete, interest and practice-driven, open-ended and highly contextualised) can require a shift in roles as teachers become knowledge managers and students become self-directed learners (Schuck et al., 2017). This shift in control from teacher to learner can readily be facilitated through technology (Cox, 2013). In addition, integrating informal learning practices in the formal classroom, drawing on the personal and social contexts of the students for knowledge construction, often remains challenging due to timetabling restrictions, mismatch with assessment practices, and lack of technology infrastructure.

Bridging formal and informal learning needs teachers' guidance to enable learning to take place across contexts (Boticki et al., 2015). This is particularly important given that generic digital tools rarely offer pedagogical support (Laru & Jarvela, 2015). Teachers must be more flexible and creative in order to integrate informal learning practices and exploit the resources available outside the classroom (Deng et al., 2016; Sharples, 2015; Stocklmayer et al., 2010) or to build learning activities around students' personal interests (Deng et al., 2016). For example, Sharples (2015) notes that teachers can use learning undertaken outside the classroom, such as science inquiry activities, as a starting point for a lesson but that this requires them to improvise and actively make connections to the curriculum. Providing support to learners to help them make connections across sites can ensure that learning experiences are re-contextualised and that students pursue their interests and develop them

further (Hung et al., 2012; Lopez & Caspe, 2014). Family support is also an important enabler of bridging learning across sites (Lopez & Caspe, 2014). Technologies, such as social media and mobile devices, can enable a variety of stakeholders to support students.

Students' interest-driven learning out of school is also connected to their extra-curricular activities in school (Deng et al., 2016). After-school extracurricular activities run by teachers can provide further opportunities for learners' personal interests to be leveraged and linked to formal learning (Deng et al., 2016). In addition, teachers can extend support to other after-school providers through participating in their events, planning and designing lessons collaboratively with informal educators to ensure the topics taught in both the settings connect enabling knowledge to be deepened for students.

Divides, cultural tensions and ethical concerns.

Students need to have ubiquitous access to technologies including mobile devices to harness the potential benefits of bridging learning across sites (Lai et al., 2013) and as noted above this is often not the case in developing countries (Davies & Eynon, 2015). Limited finances can constrain access to out-of-school resources such as technology and Internet access leading to inequalities in relation to informal learning opportunities (Lopez and Caspe, 2014). After-school clubs and informal learning centres (as provided in India) can bridge this digital/cultural divide. When ubiquitous access is a possibility, young people's everyday practices with smartphones, such as texting and checking social media accounts can be perceived be educationalists as disruptive (Hsi, 2007) with some arguing that their adoption in formal education has a negative impact on learning outcomes (Beland & Murphy, 2015).

Although it is commonly reported that young people's uptake of technology is high, levels of engagement vary from none at all to sophisticated practices. Children can be 'passive recipients' of online content rather than active producers of it (Ito et al., 2013); that is they

may not engage fully in socio-collective and rich learning activities through technology. Students do not always have the skills or interest in using technology such as social media to support learning (Erstad, 2012; Chen & Bryor, 2012).

Young people can associate technology use outside school with play and everyday activities whereas acceptable school use is typically linked to work and academic learning (Hsi, 2007). They do not feel that their everyday uses of technology are valued by their teachers nor recognise the ways in which they could be appropriated to support formal learning (Chen & Bryor, 2012). Indeed, some students consider accessing social media in the classroom inappropriate and a distraction suggesting that pedagogical scaffolding is required to maximise its impact in classrooms (Mao, 2014). Even when the learning activity is orchestrated by a teacher across multiple contexts, students can find it difficult to apply the knowledge from outside the classroom to the learning that takes place inside it (Sharples, 2015).

From an institutional perspective, increasing accountability, high-stakes testing and a curriculum based on declarative knowledge constrain opportunities to integrate informal learning practices (Erstad & Sefton-Green, 2013; Ito et al., 2013). This leads to a culture clash between in- and out-of-school learning (Ito et al., 2013). Furthermore, assessment practices can be challenged by the adoption of informal learning practices (Birdwell et al., 2015). Formal assessment structures do not always value and/or recognise knowledge acquired from everyday informal experiences and social learning (Chen & Bryor, 2012; Lemke et al., 2015). School structures inhibit recognition and accreditation of learning that takes place outside established systems and curricula. Yet learning arising from informal practices needs to be valued and the knowledge legitimised (Hsi, 2007; Rajala et al., 2016). Authentic and ongoing strategies such as rubrics, portfolios and badges can support the assessment of informal learning (Boticki et al., 2015; Chen & Bryor, 2012).

Teachers may resist the changes required to integrate the seemingly contradictory informal learning practices in their pedagogies (Chen & Bryor, 2012; Weigel et al., 2009); they need to be open to change, recognise the value of everyday learning and make connections to students' interests (Eshach, 2007; Schuck et al., 2017). Time constraints may also be an issue (Birdwell et al., 2015; Chen & Bryor, 2012). In some cases, non-formal educators may have different levels of experience and qualifications from formal educators; this difference could lead to tensions if these educators from different backgrounds work together to support learning across sites.

Tools and Internet sites commonly used outside school (e.g., YouTube, MSN) are often restricted inside school for safe-guarding reasons (Chen & Bryor, 2012; Davies & Eynon, 2015; Merchant, 2012); in particular collaboration and communication through technology is prevented or minimised. In comparison, access to technology outside schools is more open and sometimes not controlled in any way whatsoever. Controlled access in schools can be partially addressed by encouraging the use of digital tools and resources to support homework (Davies & Eynon, 2015) although of course not all young people have access to technology outside school.

It is also argued that incorporating informal learning practices in formal education can be viewed as an invasion of private spaces and a 'pedagogisation of everyday life' (Sefton-Green & Erstad, 2016) with the possibility that students may resist such endeavours (Weigel et al., 2009). From an alternative perspective, the ubiquity of technology meaning that learning can take place anytime and anywhere can have negative implications for the work-life balance (Chan et al., 2006).

Bridging Formal and Informal Learning Through Technology Without Ubiquitous Access

Of course, in many developing countries access to the Internet and technology is not ubiquitous (Davies & Eynon, 2015). The uptake of technology in developing countries is constrained by insufficient access to electricity, Internet connectivity and bandwidth, particularly in rural areas (Brewer et al., 2005). In many parts of India, the digital divide is all too apparent and is mediated by the variables of gender, age and socioeconomic status (Kumar et al., 2010). In many developing countries like Brazil and India, informal learning can enhance formal education by fostering learning centered on life skills, cultural identity, and respect for diversity (Hoppers, 2006). In addition to classroom use, research shows that mobile phones can increase access to and support learning beyond the classroom walls and lifelong learning (Kumar et al., 2010).

A vignette of an after-school learning context in a rural and tribal dominated region in Bengal, East India, drawing on co-author Charania's work, is now presented. Inhabited by Santhal and Kora tribes, some villages are underdeveloped in socio-economic terms. Most of the tribal children attend the government-funded schools but they struggle with the official language of instruction, Bengali, which is different to their native language. Similarly, teachers and parents face communication challenges. Standardized state textbooks dominate the instruction at schools and have no relevance to their immediate culture; teaching practices tend to be teacher-centred. Suchana, a local Non-Government Organization (NGO), established an after-school learning centre for the tribal children, providing academic support, bridging the language barriers, and welcoming parents as active participants.

In 2013, Suchana adopted and implemented the Tata Trusts initiative, 'Integrated approach to Technology in Education' (ITE) (Charania, 2015). ITE is a pedagogical framework designed to foster authentic and project-based learning for young people who live in some of the most

underprivileged locations in India. Students, mostly first time computer users, create learning artefacts to deepen their learning of content, for example graphical representations of jute production in India. Through Suchana, all the projects assigned to students are carefully selected by the informal educators and match the local school curriculum. Suchana also engaged with local school teachers, inviting them to exhibitions at which students showcased their projects, providing opportunities for educators to meet parents. These events served as platforms of exchange and boundary crossing between formal (school) and non-formal (learning centre) sites. Three remote learning centres were subsequently opened by Suchana with funding from Tata Trusts; a mobile van carried charged-up laptops, solar lights, Internet dongles and also books between them.

ITE projects multiplied at these learning centres and many authentic projects connected to school curricula were created. For example, students used video and spreadsheets to measure speed, distance and time in cycling and athletics. The adoption of ITE at the learning centres improved: student attendance and interest in school subjects; digital skills including showcasing work; collaboration skills; authentic learning experiences; and improved teaching processes.

In 2014, Suchana introduced community projects during vacation periods using project-based learning and authentic activities to focus on social issues, rather than school curricula. In one example, adolescents created a video about their local river, interviewing community members to understand its changing flow over time and how it affected the community's lifestyle. This project also raised awareness about cultural and environmental change. Students seemed more engaged in community projects compared to those focusing on school subjects. Vacation periods offered more and flexible time; the community projects were relevant to their immediate lives, providing opportunities to change their own social realities.

In 2015, Suchana strengthened their interaction with the government schools and extended ITE to formal education, directly implementing ITE in four government schools. They trained school teachers and administrators, negotiated space in the school timetable and supported teachers implementing ITE projects in the schools. These schools had no computers or Internet connectivity and had irregular power supply. Suchana provided charged up laptops and dongles to facilitate connectivity. Through this initiative, the schools have realized the potential of digital technologies to facilitate learning and student interest, both very difficult goals to achieve in a lower socio-economic context where even the benefits of completing formal education are unclear.

Thus, the initiative that was developed initially at the learning centres was subsequently integrated within the mainstream schooling system shifting informal learning practices into the formal context of school. Suchana continued to run its learning centres before and after school serving as resource points for schools taking up ITE: creating lesson plans, organizing events for showcasing students work; and bringing teachers and the community together. They also provided technical support, charged the laptops and prepared dongles for delivery to schools.

The learning centres are not bound by timetabling and language of instruction at schools; they have access to community space and culture to explore subjects in real-life situations, and greater flexibility when working on community projects. They provide deep authentic learning experiences and a sense of agency for young people, developing life-long learning skills, supporting social and personal transformation in young people's lives and their communities. The adolescents cross contextual boundaries using their newly developed digital skills and basic technologies (i.e. laptops), working towards similar goals, using the framework of ITE. The deep and authentic learning experiences undertaken outside the school context intersect with formal education whilst utilising a flexible and open

environment. Given the tribal and school culture which is largely compliant with members accustomed to being directed by those in authority, this learning was not self-directed. ITE uses technology, links to school subjects, and develops skills such as collaboration, problem solving and critical thinking, and creativity. These being lifelong learning skills, it is likely that in the long run these adolescents will become more self-directed in creating such learning opportunities for themselves.

Conclusions

A comprehensive review of recent literature on how informal learning, including everyday knowledge and informal practices, could help to reshape formal education has been presented. To harness the potential benefits of informal learning in formal contexts, there is a need to shift formal pedagogical practices from transmissive approaches to collaborative, student-centred and self-directed approaches to create opportunities for young people to draw on everyday knowledge and practices (Khaddage et al., 2016). Indeed, a recent Horizon report for K-12 (Adams Becker, Freeman, Giesinger Hall, Cummins, & Yuhnke, 2016) predicts greater uptake of problem-based learning, collaborative, self-directed and active learning, with the growth of remote interaction, all facilitated by technology.

However, whilst there are strong arguments for bridging formal and in/non-formal learning there is still limited understanding of the interrelationship between using technology in school for learning and using technology outside school for a wide range of learning activities (Cox, 2013; Hung et al., 2012). It is also clear that there remain many challenges in relation to pedagogy, technology, policy and research (Khaddage et al., 2016; Kumpulainen & Sefton-Green, 2014; Schuck et al., 2017). Indeed, there are broader cultural tensions, and moral and ethical concerns relating to bridging learning, as discussed above. Khaddage and colleagues (2016) argue that the difficulty of developing a shared understanding of informal learning is

one barrier to the development of pedagogies that bridge different types of learning. However, it is better to accept informal learning as a slippery and complex concept, and to focus instead on the formal and informal attributes of learning (Colley et al., 2003; Greenhow & Lewin, 2016). Khaddage and colleagues (2016) also note that it is difficult to capture informal learning as it happens and assess its outcomes. In addition, there are relatively few models of good practice for bridging formal and in/non-formal learning (Merchant, 2012). From an ethical perspective, the danger of blurring boundaries and attempting to capitalise on learning that takes place outside the school is that people's personal spaces are invaded potentially having negative impact on learners' engagement and outcomes (Sefton-Green & Erstad, 2016).

In the past, a lack of infrastructure has been noted as a significant barrier to integrating technology in formal education. This is not necessarily the case any longer in developed countries although further investment is still required to support increased use of mobile technologies in classrooms. Infrastructure capabilities are also being improved in many developing countries. For example, the Digital India initiative funded through the Indian Government aims to provide universal mobile connectivity. In the future, this should ensure better access to digital educational resources particularly in rural areas of India. Formal institutions like the National Institute of Open Schooling in India which allows non-traditional learners to pursue secondary-level education in a non-formal context, should harness the growth in mobile connectivity to increase their outreach and quality of delivery.

In order to maximise the potential of bridging formal and in/non-formal learning, school cultures need to change. The boundaries between in and out-of-school need to be recontextualised to create "possibilities for participation, interaction, and collaboration across a diversity of sites and contexts, both within and across institutions" (Kumpulainen & Sefton-Green, 2014, p.13). It would be beneficial to view learning as an ecosystem, considering a

communities rich assets such as designed settings (eg after-school clubs, museums), natural settings (eg geographical areas, historical sites), people and networks of people (enthusiasts, experts) and everyday encounters (at home, online) (NRC, 2015). It would also be beneficial to reconsider "what constitutes appropriate kinds of knowledge, ways of learning and pedagogic relationships" (Sefton-Green & Erstad, p.3). Strong collaboration between all stakeholders including learners, teachers, parents, and policy makers is necessary to ensure that all knowledge is valued and recognised (Banks et al 2007). However, it is unlikely that such cultural shifts will take place whilst curriculum constraints, timetabling, high-stakes testing, subject silos and risk aversion continue to act as barriers to innovation and change (Adams Becker et al., 2016; Schuck et al., 2017).

Professional development for teachers and out-of-school educators is one means of addressing current challenges (Khaddage et al., 2016; NRC, 2015), both in developed and developing countries. Teachers need to understand the possible benefits of harnessing both informal learning practices and the knowledge and skills developed through everyday practices to support the achievement of formal learning outcomes (Banks et al., 2007). Teachers also need to be prepared to take more risks and experiment with their classroom pedagogies. This requires support and encouragement from school leaders. In addition, more work around assessment is required. There is a need for mechanisms to recognise the complex and varied outcomes that arise in out-of-school learning and to develop ways of comparing data from in and out-of-school learning (NRC, 2015).

Students also need to be offered more support and guidance from their teachers in order to make more connections between learning in and outside school. It would be beneficial to ensure that they have the skills required to harness the full potential of technology to support all forms of learning, particularly in relation to the development of supportive networks and

identifying relevant online communities. This is essential if students are to be equipped with the means to continue using technology to support lifelong learning.

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